MODEL 41-3A
CENTRAL OFFICE SERVICE ANALYZER

INSTALLATION AND OPERATION

Northeast Electronics Instruction Manual
A0041-13-600 Issue 1A September 1977

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679-810

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ADDENDUM NO. 1
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AD1.1 This addendum contains:

1. additional instructions on how to properly enter interdigital time intervals into the test set, and

2. information concerning the input resistance of the test set and its effect on the loop resistance.

AD1.2 INTERDIGITAL TIME

AD1.3 The time interval between the end of the last break time of a digit and the start of the first break time of the next digit defines the interdigital time between two digits. The interdigital time, as generated by the TTS 41-3A Service Analyzer, consists of the last make time of a digit pulse plus a specified IDT (interdigital time) interval. A digit, as generated by the test set, consists of a series of pulse periods, each pulse period consisting of a break and a make time. The break and make times depend on the specified pulsing speed and percent break. The values for the pulsing speed, the percent break, and the IDT are entered into the test set via the DIALER PROGRAM thumbwheel switches.

AD1.4 To correctly specify an interdigital time, it is necessary to account for the last make time generated by the 41-3A. The following steps illustrate a method to correctly enter a specified interdigital time.

1. Read the value entered in the PPS section of the DIALER PROGRAM thumbwheel switches for the pulsing speed.

2. Read the value entered in the %BRK section of the DIALER PROGRAM thumbwheel switches for the percent break.

3. Obtain the make time from Figure AD1—1 as follows:

   a. Find the intersection point of the lines for specified pulsing speed and percent break values.

   b. Locate the nearest diagonal line near the intersection point.

   c. Read the make time in milliseconds at either end of the diagonal line.

4. Subtract the make time from the required interdigital time.

5. Enter the obtained result into the IDT section of the DIALER PROGRAM thumbwheel switches.

AD1.5 LOOP RESISTANCE

AD1.6 Several solid state devices within the line interface circuits of the Model TTS 41-3A cause the input resistance of the test set to be about 33 ohms. This resistance can vary depending on supply voltage and polarity. The resistance affects the total resistance seen by the circuit under test when using loop resistance, and can result in some small measurement errors. Table AD1—1 lists the nominal loop resistance, the resulting loop resistance, and the percentage error in the loop resistance for all the positions of the LOOP control.

Table AD1—1. Loop Resistance.

Position	Nominal Value	Actual Value	Error Percentage
6	600	633	6.2
8	800	833	4.1
10	1,000	1,033	3.3
11	1,100	1,133	3.0
12	1,200	1,200	0.0
13	1,300	1,333	2.5
14	1,400	1,433	2.4
15	1,500	1,533	2.2
16	1,600	1,633	2.1
18	1,800	1,833	1.8
19	1,900	1,933	1.7

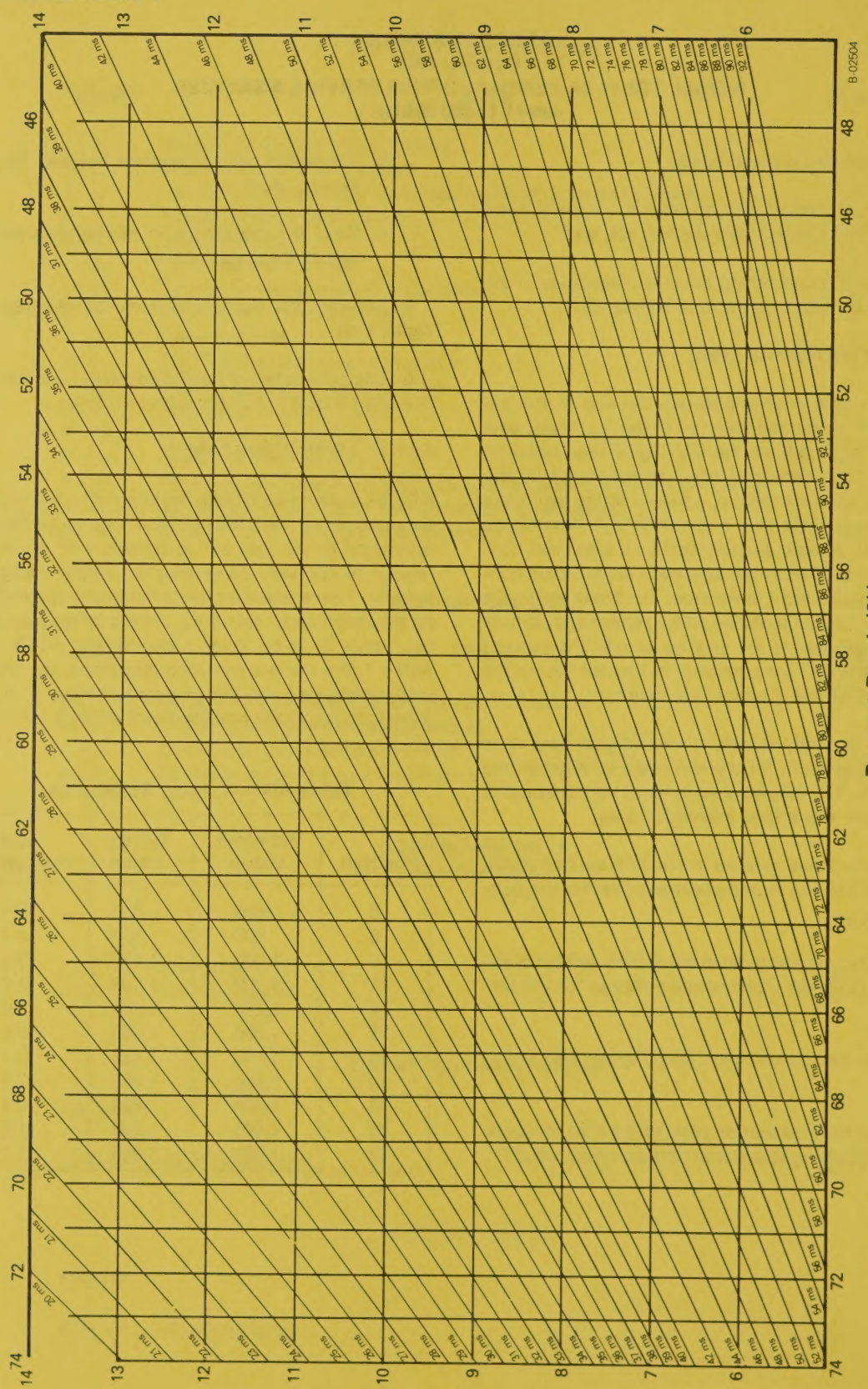


Figure AD1–1. Make Time Graph.

SECTION 1

GENERAL DESCRIPTION

1.1 This manual describes the Northeast Electronics Model TTS 41-3A Service Analyzer. The analyzer is a comprehensive instrument that combines the many functions of a routiner, automatic dialer, and call-through test set.

1.2 The analyzer has a large selection of programmable test and failure analysis capabilities. It can be programmed to:

a. automatically dial a number assigned to its own internal test line (or dial the number of any other test line);

b. analyze the progress and results of each call attempted;

c. store the number of calls attempted and the number of calls that tested OK . . . plus the number of failures in up to 12 different categories for calls that did not test OK;

d. display the stored numbers.

1.3 Programming is selected by front panel controls. Status data and test results for each call are displayed as lighted messages on a dark panel background. Test result total counts are displayed on a digital readout.

1.4 The analyzer can be programmed to halt automatic operation and hold switched connections for troubleshooting when specific types of failures are detected. Or, programming can allow automatic calling to continue in order to collect and tabulate data on overall office performance.

1.5 ORIGINATING LINES

1.6 Up to 16 telephone lines can be connected to the analyzer for test call origination. Connections are made via rear-panel type 310 jacks. Call origination lines can be either 600 or 900-ohm 2-wire circuits (T/R or T/R/S).

1.7 The analyzer has two channels. Up to 8 of the originating lines can be connected to channel A, and up to 8 lines can be connected to channel B.

1.8 Programming specifies whether calls will originate on channel A lines only, channel B lines only, or will alternate between channel A and B lines. In all cases, the analyzer automatically scans and checks for idle/busy until an idle line is found. Automatic calling can continue on one channel even when the other channel is stopped for tracing and troubleshooting on a failed line.

1.9 A distinctive trace tone can be coupled onto a line held by the analyzer to aid in trouble location. A talk circuit and jacks for a type 52A headset allow voice communication over a held line. External test equipment may be connected through an external jack on the analyzer for either bridged or terminating connection to a held line.

1.10 BUILT-IN TEST LINE

1.11 The TTS 41-3A has its own internal test line that can be wired to an incoming telephone circuit to receive calls placed by the analyzer. Thus, operation of the analyzer need not tie up any regular telephone office test lines.

1.12 The built-in test line can be tripped to off-hook by a 20 to 60-Hz ringing signal across its T/R leads. When tripped by ringing, the test line couples a 1-kHz tone to the circuit for transmission tests. The sleeve can be monitored, and a potential more positive than −7 volts or an open is considered an active (busy) lead.

1.13 When calls are programmed to the internal test line, a TEST OK is recorded for each call that successfully trips the test line within a programmed NETWORK DLY period after dialing, only if an active sleeve is detected. If the incoming circuit has only T/R leads (no sleeve lead), successful tripping of the test line is all that is needed for a TEST OK. Also, the unit can be made to record a TEST OK if an active sleeve only (no T/R leads) is detected within a programmed NETWORK DLY period after dialing.

1.14 FAILURE TABULATION

1.15 The following types of call completion failures can be programmed for detection and tabulation.

a. no (or slow) dial tone, or (on an optional basis) no wink-type start dial signal;

b. open C-lead after line seizure;

c. false T/R reversal supervision during dialing (discloses reversed wipers in SXS switch trains and faulty message accounting equipment);

d. reorder;

e. busy;

f. reorder and false answer supervision;

g. busy and false answer supervision;

h. no answer supervision within programmed period after dialing;

i. incoming circuit fault . . . call did not reach internal test line within programmed time period after dialing;

j. no 1-kHz tone received from a dialed signal source;

k. 1-kHz tone received from signal source deviates from programmed expected measured level (EML) by more than a programmed LO LIMIT . . . discloses excessive transmission loss;

l. 1-kHz tone received from a signal source deviates from programmed EML by more than a programmed HI LIMIT. . . discloses attenuation pad problems and/or excessive gain.

1.16 The analyzer can store up to 9999 counts for each failure category. Pressing a button for a desired category displays the count on a digital readout. The analyzer also counts and can display the number of: (a) total calls attempted, (b) total calls attempted on channel A lines, (c) total calls attempted on channel B lines, and (d) calls that tested OK.

1.17 If the count exceeds 9999 in the total tests category, an OVER RANGE message appears. After the count for any category goes over range, the count number displayed for that category shows count excess above 10,000. Counts in all other categories are unaffected.

1.18 DIALING PROGRAMMING

1.19 Panel controls permit programming either dial pulse (DP), Touch-Tone (TT) or optional multifrequency (MF) dialing and either of two start dial commands. A DELAY start dial command will initiate dialing when a programmed START AFTER period has elapsed following line seizure. A DIAL TONE start dial command will initiate dialing after receipt of dial tone following line seizure.

1.20 On analyzers equipped with multifrequency dialing, selecting the DIAL TONE start dial program conditions the unit to begin dialing upon receipt of either dial tone or wink (or similar start dial signal). Failure to receive dial tone (or wink) within a programmed FAULT AFTER period is recorded as a NO DIAL TONE fault.

1.21 The dialing number to be called is entered via a front panel keyset and is displayed on a digital readout at half brightness. After the analyzer dials out each digit during a test call, that digit is brought up to full brightness on the readout. Thus, any call completion failure detected during dialing can be pinpointed to a particular switching level by noting the relationship of half-bright to fully-bright dialing digits on the readout.

1.22 Special wait for start dial (WSD) commands can be programmed among the numeric dialing digits. The analyzer stops dialing and waits for a start dial indication (DELAY or DIAL TONE) at each point in the dialing number where a WSD command has been programmed. Thus, the analyzer can be programmed to dial through PBX-type equipment.

1.23 Up to 15 numeric digits and WSD commands can be programmed. The digital readout displays up to 11 of the numeric digits. WSD commands are not displayed.

1.24 Other parameters of the dialing signaling can also be programmed over wide limits to exercise switching equipment under various conditions. Digital thumbwheel switches select:

a. dialing speed from 1 to 99 pps (DP) in 1-pps increments, or 1 to 99 digits per second (TT and MF) in 1 digit per second increments;

b. percent break (DP) or percent tone (TT and MF) from 1 to 99 percent in 1-percent increments;

c. interdigital time (DP only) from 1 to 999 milliseconds in 1-millisecond increments. Different loop resistance and line leak values can be independently selected for DP calls.

SECTION 2

SPECIFICATIONS

2.1 Table 2—1 lists specifications for the Model TTS 41-3A Service Analyzer.

Table 2—1. Model TTS 41-3A Service Analyzer Specifications

ORIGINATING LINES	
Line Capacity:	Up to 16 lines, 8 lines maximum on each of two channels; lines connect to type 310 jacks on rear panel.
Line Type:	Wet loop type; T/R leads for dedicated circuits, T/R/S leads for non-dedicated circuits with ground control on S lead. Line impedance can be either 600 or 900 ohms.
Sleeve Lead	
Busy Condition Recognized:	Ground or any potential more positive than −7V.
Idle Condition Recognized:	Open circuit or any potential more negative than −11V. 4V of hysteresis provided to prevent indecision.
Circuit Busy-to-Reselect Circuit Time:	100 ± 1 ms.
Line Seizure (off-hook):	Active hold. 15 mA while test results are being determined; 25 mA othertimes.
DIALING	
Type:	Dial pulsing (DP) or Touch-Tone (TT); multifrequency (MF) dialing is optional.
Digit Capacity:	Up to 15 digits and instructions for programmed wait-for-start dial (WSD) stops. Entered numeric digits are displayed on test progress readout.
Digit Entry:	Front panel keyset enters the digits, WSD instructions and end of number (EON) instruction.
Dial Pulsing	
Dial Speed Range:	Selectable 1 to 99 pps in 1-pps increments.
Dialing Speed Accuracy:	± 0.1% for 1 to 30 pps range.
Percent Break Range:	1 to 99% in 1% increments.
Percent Break Accuracy:	± 1% for 35% to 85% percent break range over a 1 to 30 pps dialing speed range.
Interdigital Time Range:	1 to 999 ms in 1-ms increments.

Table 2—1. (cont'd)

Interdigital Time Accuracy:	Better than ± 1 ms.
Transient Suppression:	325 ± 25 Vdc.
Touch-Tone Dialing	
Frequency:	Pair of frequencies, one from a low frequency group and the other from a high frequency group.
Frequency Accuracy:	± 1%.
Single Frequency Harmonic Distortion:	Less than 3% over a 30-kHz bandwidth.
Single Frequency Output Level:	−6.0 ± 0.5 dBm into 900 ohms.
Dialing Speed Range:	1 to 99 digits per second in 1 digit per second increments.
Dialing Speed Accuracy:	± 0.1% for 1 to 30 digit per second range.
Tone Duration Percentage Range:	1 to 99% in 1% increments.
Tone Duration Percentage Accuracy:	± 1% for 35% to 85% tone duration range over 1 to 30 digit per second dialing speed range.
Multifrequency Dialing (optional)	
Type:	Standard R1 MF pulsing. KP and ST tones transmitted at the proper times.
Frequency Accuracy:	± 1%.
Single Frequency Harmonic Distortion:	Less than 3% over a 30-kHz bandwidth.
Single Frequency Output Level:	−6.0 dBm ± 0.5 dB into 600 ohms.
Dialing Speed Range:	1 to 99 digits per second in 1 digit per second increments.
Dialing Speed Accuracy:	± 0.1% for 1 to 30 digit per second range.
Tone Duration Percentage Range:	1 to 99% in 1% increments.
Tone Duration Percentage Accuracy:	± 1% for 35% to 85% tone duration range over 1 to 30 digit per second dialing speed range.
Twist:	1 dB or less.

Table 2—1. (cont'd)

DETECTION CRITERIA

Answer Supervision:	Recognizes T/R lead reversal lasting longer thar approximately 312 ms.
Open C-lead:	Recognizes, if instructed, loss of C-lead ground lasting longer than 512 ms. After open C-lead recognition occurs, supplies up to approximately 180 mA sleeve current in an attempt to hold switched connections.
1-kHz Level Detector	
Frequency Range:	990 to 1020 Hz.
No Tone Threshold:	−31 ± 1 dBm from 900/600 ohms.
Response Time:	2 ± 0.5 seconds.
Level Limit Accuracy:	± 0.5 dB from +10 to −10 dBm. ± 1 dB from −11 to −31 dBm.
Busy/Reorder Detector	
Frequency Range:	200 to 650 Hz.
Sensitivity:	−30 dBm from 900/600 ohms.
Busy Pulse Modulation Rate:	45 to 75 ipm.
Reorder Pulse Modulation Rate:	100 to 140 ipm.
On/Off Level Ratio:	Greater than 6 dB.
Number Of Interruptions:	3 for busy tone, 6 for reorder tone.
Tone On Duty Cycle:	20 to 80%.
Wink/Delay Dialing Detection: (multifrequency equipped units only)	Reversed tip/ring polarity present on the line under test for at least 128 milliseconds followed by a return to normal polarity that lasts for at least 128 milliseconds. The line under test can be in either the normal or reversed state prior to seizure.

INCOMING CIRCUIT TEST LINE

Pre-Trip Impedance:	Approximately 47 kohms at 20 Hz.
Trip Impedance:	Approximately 850 ohms at 20 Hz.
Trip Criteria:	20-60 Hz ringing voltage across T/R leads at 65 volts rms or greater.
Quantity Of Rings To Trip:	1 lasting for more than 600 ms.

Table 2—1. (cont'd)

Sleeve Active (Busy) Condition Recognized:	Open Circuit, ground, or any potential more positive than −7V.
Sleeve Inactive (Idle) Condition Recognized:	Any potential more negative than −15V. 8V of hysteresis provided to prevent indecision.
Signal Output:	1004 ± 10 Hz at 0 dBm into 900 ohms.
INTERNAL TRACE TONE	
Frequency:	1165 ± 500Hz, gated on/off at 4 Hz rate (240 ipm).
Tone-On Level:	Approximately 0 dBm into 900 ohms.
Loop Holding Resistance:	900 ± 90 ohms dc.
DATA STORAGE	
16 Data Registers:	0 total tests. 1 tests on channel A. 2 tests on channel B. 3 no dial tone (and/or no wink). 4 open C-lead. 5 reversal during dialing. 6 reorder and answer. 7 busy and answer. 8 reorder (and no answer). 9 busy (and no answer.) 10 low level. 11 no 1-kHz tone. 12 high level. 13 no answer. 14 incoming circuit fault. 15 test OKs.
Storage Capacity:	9999 events per register, instant recall via individual readout switches. Over range indication if a register count exceeds 9999 (total tests register) without affecting contents of other registers.
INPUT POWER:	105 to 120 or 215 to 240 Vrms, 50 to 60 Hz, approximately 60 watts.
OPERATING ENVIRONMENT	
Temperature:	+32°F to +122°F (0°C to +50°C).
Humidity:	0% to 90% relative.
MECHANICAL	
Size:	9 in. h x 17 in. w x 18 in. d (23 cm x 43 cm x 46 cm).
Weight:	Approximately 40 pounds (18.2 kg).

SECTION 3

INSTALLATION

3.1 This section provides the information needed to install the Model TTS 41-3A Service Analyzer and to verify its operating condition after shipment.

3.2 VISUAL INSPECTION

3.3 After unpacking the unit, check to see that it has been shipped with an 8-foot, 3-wire ac power cord. Examine the exterior of the unit for visible damage caused by shipment. It is not necessary to inspect the unit's interior.

3.4 MOUNTING

3.5 The analyzer is a portable instrument and can be placed on any convenient work table surface or shelf. The analyzer does not come equipped for permanent rack mounting. If it is desired to mount the analyzer in a rack, a shelf should be mounted in the rack to hold the analyzer.

3.6 Figure 3—1 shows the analyzer's major dimensions. Note that clearance of at least five inches is required in back of the analyzer for cooling air flow inlet and cable connections. Also, clearance of at least one inch is required at the top and on each side for cooling air flow.

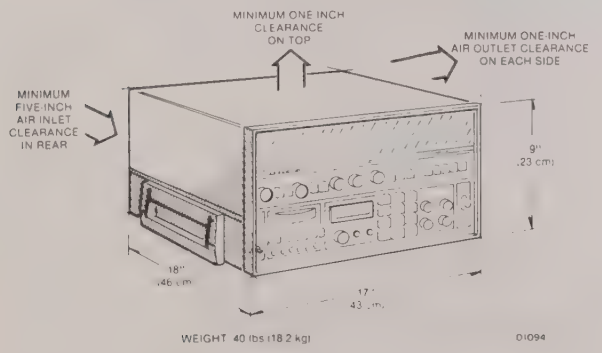

MINIMUM ONE INCH CLEARANCE ON TOP
MINIMUM ONE-INCH AIR OUTLET CLEARANCE ON EACH SIDE
MINIMUM FIVE-INCH AIR INLET CLEARANCE IN REAR
9" (23 cm)
18" (46 cm)
17" (43 cm)
WEIGHT 40 lbs (18.2 kg)
01094

Figure 3—1. Model TTS 41-3A Outline Drawing

3.7 POWER CONNECTION

3.8 The unit operates on 105 to 120 Vac or 215 to 240 Vac, 50 to 60 Hz power. Be sure the rear panel SELECT VOLTAGE switch is properly positioned for the power source used.

CAUTION

Two-ampere slow blow fuses, required for 115-volt operation, are installed in the rear panel fuse holders at the factory. These fuses must be changed to 1-ampere slow-blow when 230-volt operation is selected.

3.9 The power cord supplied with the unit has a standard NEMA 3-prong, wall-outlet type plug at one end. The other end mates with a 3-prong connector located on the unit's rear panel. The analyzer consumes about 60 watts of power.

NOTE

Besides meeting safety standards, the NEMA ground pin on the power cord establishes a common reference between telephone office ground and the analyzer's chassis ground. Do not modify this connection as it will affect operation of the unit.

3.10 PRE-INSTALLATION CHECKOUT PROCEDURE

3.11 The following procedure is a means of generally verifying the analyzer's operational status after shipping before installation. No telephone lines should be connected to the analyzer during this procedure.

INITIAL SETTINGS

1. Set POWER switch down.
2. Release all press-to-engage switches.
3. Set all timing controls for their nominal times (12 o'clock positions).
4. Set MODE switch to IDLE.
5. Set LEAK/LOOP switches to NORM.
6. Set TT/DP/MF to TT.
7. Set DIALER PROGRAM thumbwheel switch for SPEED of 1 digit per second, and a tone-on period (% BRK digits) of 50%. (The IDT digits are not used in this procedure.)
8. Set RESET/→/NORM switch to NORM.
9. Set MASTER and DIALING VOLUME controls to midrange.
10. Insert a dummy (not wired) type 310 plug into front panel LINE CONTROL A jack.

ACTION	RESULT
1. Set POWER switch to ON.	All indicators except channel A and channel B TEST, TRACE, BUSY light. POWER INTERRUPT indicator flashes. All readouts display 8's.
2. Press RESET pushbutton for at least one second.	POWER INTERRUPT indicator stops flashing. TEST RESULTS readout becomes blank. The following indicators are lighted. a. A IDLE b. B IDLE, c. TEST PROGRESS IDLE, d. PROGRAM ERROR.
3. Press to engage TEST A pushbutton.	
4. Press to engage DELAY pushbutton.	
5. Press to engage ANS SUP pushbutton.	PROGRAM ERROR indicator goes out.
6. Set RESET/→/NORM switch at RESET then at load (→).	TEST PROGRESS readout becomes blank.
7. Use keyset to enter 1234567890 EON into dialer.	Digits are displayed in TEST PROGRESS readout at half brightness.
8. Set RESET/→/NORM switch at NORM.	
9. Check to be sure START AFTER control is set to 4 seconds.	
10. Press to engage FAULT pushbutton.	

ACTION	RESULT
11. Set MODE switch to AUTO.	The analyzer places a single test call. The TEST A indicator should light. Indicators in the TEST PROGRESS section of the front panel should indicate which operation the unit is performing. After each digit is dialed, it is displayed at full brightness. Touch-tone signals can be heard from unit's speaker. (Adjust DIALING VOLUME control as necessary.) After the DIALING COMPLETED WAITING FOR TEST RESULTS period ends, the NO ANSWER and SYSTEM HELD indicators light. An alarm tone should be heard from the unit's speaker. NOTE If alarm volume is unsatisfactory refer to paragraph 3.12. The digit 1 appears in TEST RESULTS readout.
12. Press NO ANSWER pushbutton.	TEST RESULTS readout indicates 1.
13. Press NO DIAL TONE pushbutton.	TEST RESULTS readout is blank.
14. If desired, place another test call by placing MODE switch momentarily at IDLE, then return to AUTO. When satisfied with analyzer's performance, set POWER switch down.	
15. Successful completion of above steps indicates analyzer has been shipped without internal damage and is ready for installation and use.	

3.12 ALARM VOLUME ADJUSTMENT

NOTE

This adjustment is to be made only if the alarm volume is unsatisfactory.

3.13 To adjust the analyzer's alarm volume perform the following steps.

1. Set POWER switch down.

2. Remove the unit's top cover by removing a retaining screw on each side of the unit near the rear corners.

3. Place card 5 (ejector marked 5) on a suitable extender board.

4. Be sure no telephone lines connect to analyzer and perform checkout procedure of paragraph 3.10. Stop at step 11.

5. Refer to Figure 3–2 and adjust the alarm volume potentiometer until volume is satisfactory.

6. Set MODE switch to IDLE.

7. Set POWER switch to OFF.

8. Replace card 5 and analyzer top cover.

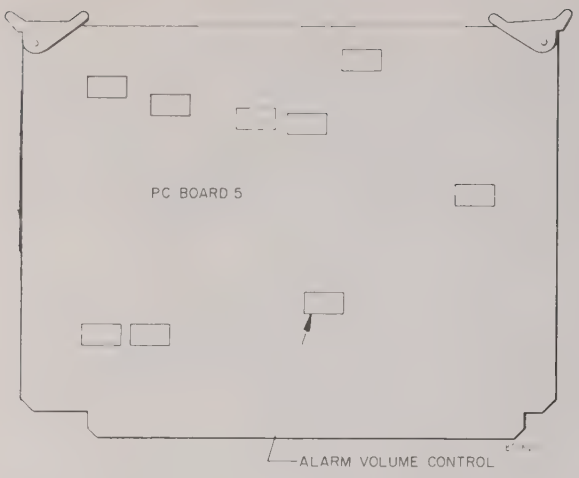


Figure 3—2. Alarm Volume Adjust Control

3.14 TELEPHONE LINE CONNECTIONS

3.15 Up to 16 wet-loop type 600 or 900 telephone lines (either T/R or T/R/S) can be connected to the unit for test call origination. Do not connect sleeve leads of the circuits under test when the analyzer is used in a #5 crossbar office. The lines connect to jack fields on the rear of the unit via standard type 310 plugs. (Figure 4—14 shows the jack field and other rear panel connection points). It is normal practice to evenly distribute lines between channel A and channel B. This allows troubleshooting on a held line on one channel while testing is in progress on the other channel.

3.16 For convenience, one or two lines can be connected to the unit via channel A and channel B jacks on the front panel. Type 310 plugs are used for these connections also. When a line is connected to either of the front panel jacks, the rear jack fields are automatically disabled.

3.17 If the analyzer's internal test line is to be used, an incoming circuit must be connected to the INCOMING CIRCUIT terminals on the barrier strip in the rear of the unit. The incoming circuit connections to the barrier strip can be: (a) T/R/S, or (b) T/R only, or (c) S only.

3.18 The internal test line contains a 1-kHz tone source. The 1-kHz tone will be coupled to the incoming circuit tip and ring leads when the test line is tripped by detection of 20 to 60-Hz ringing on the INCOMING CIRCUIT T and R terminals.

3.19 The analyzer is shipped with the internal test line strapped for proper operation when connected to incoming T/R/S or T/R circuits. With this normal strapping, the unit will recognize completion of calls to the internal test line by detection of 20 to 60-Hz ringing on the INCOMING CIRCUIT T/R terminals with the S terminal either: (a) open circuit, or (b) ground, or (c) any potential more positive than −7 Vdc. If a potential more negative than −15 Vdc is present on the INCOMING CIRCUIT S terminal, the analyzer will not record a call completion even if 20 to 60-Hz ringing is detected on the INCOMING CIRCUIT T/R terminals.

3.20 If it is desired to operate the analyzer with only an S lead (no T/R leads) connected to the INCOMING CIRCUIT terminals, the factory strapping must be changed. To change the strapping and implement S-lead-only call completion detection, perform the following steps.

1. Remove the unit's top cover by removing a retaining screw on each side of the unit near the rear corners.

2. Identify incoming circuit pc board 96826 located at the left rear of the unit and mounted to the rear panel.

3. Locate a jumper strap connected between terminals A and C on the incoming circuit pc board. Figure 3—3 shows the location of this strap.

4. Reposition jumper strap between terminals B and C.

5. Replace analyzer's top cover.

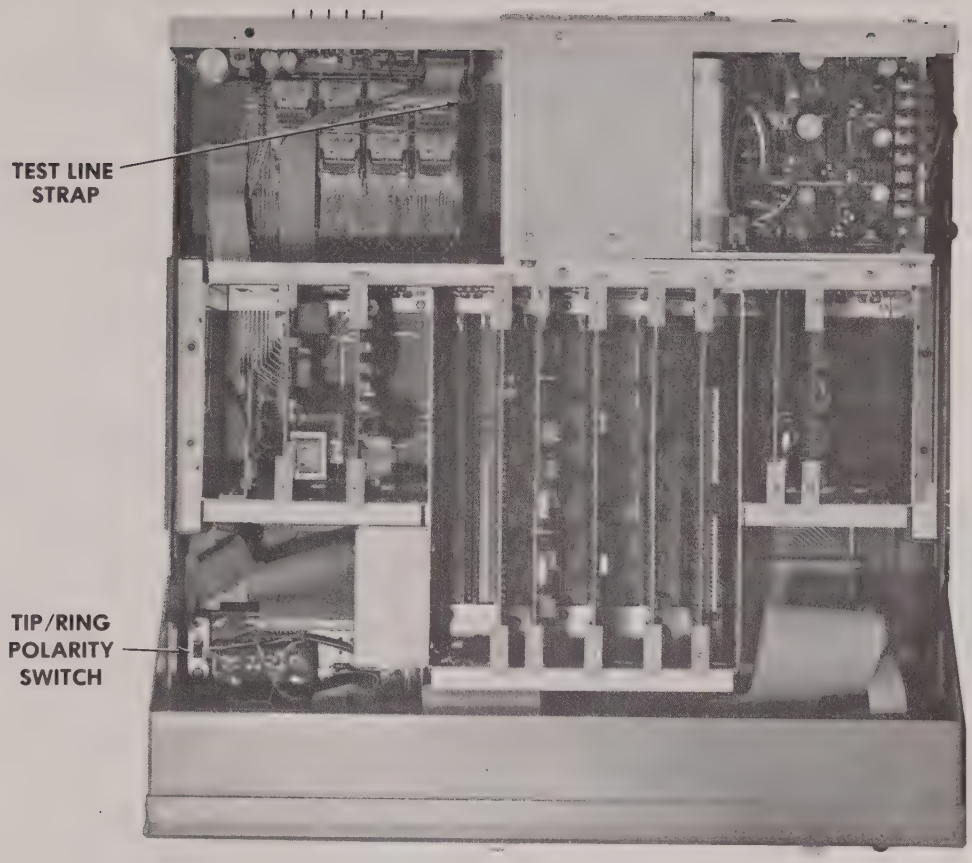


Figure 3—3. Test Line Strap And Tip/Ring Polarity Switch Location Diagram

3.21 When strapped for S-lead-only sensing, the unit will recognize completion of calls to the internal test line when the INCOMING CIRCUIT S terminal becomes either: (a) open circuit, or (b) ground, or (c) any potential more positive than −7 Vdc. When a potential more negative than −15 Vdc is present on the INCOMING CIRCUIT S terminal, the analyzer will not record a call completion.

3.22 **TIP/RING POLARITY CHECK**

3.23 After call origination lines are connected to the analyzer, a check must be made to determine if the unit is compatible with the tip/ring polarity of the call origination lines.To make this check, perform the following steps.

1. Engage the following pushbuttons:

   (1) TEST A,

   (2) TEST B,

   NOTE

   If a single call origination line connects to a front panel channel A or channel B jack, engage only the TEST pushbutton corresponding with the channel used.

   (3) DELAY,

   (4) ANS SUP.

2. Set Mode switch to IDLE.

3. Set POWER switch to ON.

4. Press RESET pushbutton for at least one second. The analyzer should select an idle call origination line at this time.

5. Observe front panel LINE CONTROL meter. If meter reads almost full scale to the left (REVERSE), analyzer is incompatible with the tip/ring polarity of the call origination lines. This condition can be corrected by changing the position of an internal switch as described in the following steps. If LINE CONTROL meter reads almost full scale to the right (NORMAL), analyzer is compatible with call origination lines and hence, no further steps are necessary. (Set POWER switch down if meter reads NORMAL, otherwise continue with procedure.)

NOTE

Some loop trunks are in the off-hook (REVERSE) state when idle. When the analyzer is used with this type of trunk, the internal tip/ring polarity switch must be set such that the front panel meter indicates REVERSE when an idle line is selected.

6. Remove the unit's top cover by removing a retaining screw on each side of the unit near the rear corners.

7. Refer to Figure 3—3 to locate the internal tip/ring polarity reversal switch at the left front of the unit.

8. Set switch to its other position. Meter should read almost full scale to the right.

9. Replace analyzer's top cover and set power switch down.

3.24 After the tip/ring polarity check as described above has been made, installation is complete and the unit is ready for normal operation.

SECTION 4

OPERATION

4.1 This section contains operating information for the TTS 41-3A Service Analyzer. General operating instructions are given first, followed by example applications. The example applications show how the analyzer can be used to perform specific routining tasks. For reference purposes, complete control and indicator tables and illustrations are provided at the end of this section.

NOTE

Proper operation of the analyzer requires that the tip/ring polarity check, given in paragraph 3.22, be made at the time of installation. If the installation instructions given in Section 3 were followed previously, this check has already been made.

4.2 GENERAL OPERATING INSTRUCTIONS

4.3 The following paragraphs contain the information needed to properly program and operate the Model TTS 41-3A Service Analyzer.

4.4 PREPARATION FOR USE

4.5 The analyzer should be connected to a source of ac power and to telephone lines as described in Section 3 of this manual. Before operating the analyzer, make the following initial control settings.

a. POWER switch down.

b. All press-to-engage switches released.

c. LEAK/LOOP switches to NORM.

d. TT/DP/MF switch to DP.

e. RESET/→/NORM switch to NORM.

f. MODE switch to IDLE.

g. SYSTEM TIMING and MON controls to 12 o'clock.

h. START DIAL COMMAND controls to 12 o'clock.

i. DB switches to 12 o'clock.

4.6 INITIAL POWER-UP AND RESET

4.7 To energize the analyzer and prepare it for programming, set POWER switch to ON and press RESET pushbutton for at least one second. (See Figure 4—1.) The RESET pushbutton must be pressed whenever the unit is powered-up and anytime there is an interruption of the unit's ac power. The following indicators should be lighted at this time:

a. A IDLE or A BUSY,

b. B IDLE or B BUSY,

c. TEST PROGRESS IDLE,

d. PROGRAM ERROR.

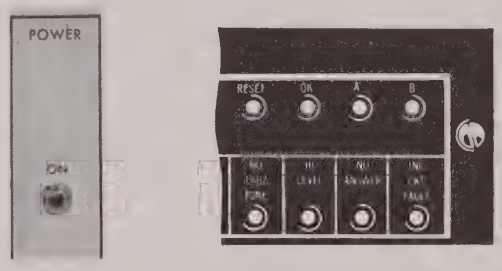


Figure 4—1. Power-Up And Reset Controls

4.8 LINE CONTROL PROGRAMMING

4.9 The line control program allows the user to place test calls on channel A and/or channel B lines as desired. Normally, both TEST pushbuttons are engaged to condition the analyzer for testing on both channel A and B lines. (See Figure 4—2.) If two-channel testing is selected, **and** all lines are idle, test calls will alternate between channel A and channel B. (Busy lines and empty rearpanel circuit selector jacks are automatically bypassed.)

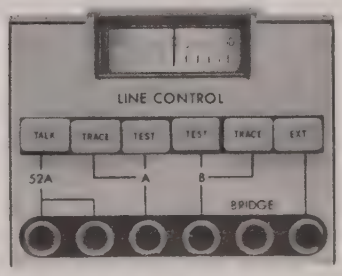


Figure 4—2. Line Controls

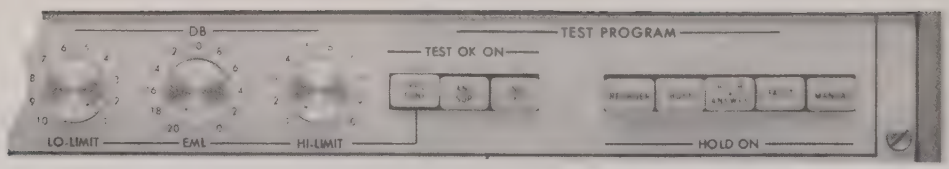


Figure 4—3. Test Program Controls

4.10 Single channel testing can be selected whenever desired by the user to obtain call completion data for one channel. If testing on channel A lines only is desired, engage only the TEST A pushbutton. Similarly, engaging only the TEST B pushbutton selects channel B only testing.

NOTE

One or both TEST pushbuttons must be engaged to avoid a program error condition.

4.11 The analyzer's TRACE function is used only for troubleshooting (as described in paragraph 4.46) and hence, the TRACE pushbuttons are normally released. The TALK and EXT pushbuttons are also normally released. If an explanation of the TALK, EXT, or BRIDGE functions is desired refer to Table 4—3.

4.12 TEST PROGRAMMING

4.13 The analyzer's test program determines (a) the tests to be performed on call origination lines and (b) what conditions, if any, will cause the analyzer to halt automatic operation and hold (remain off-hook) the line under test for troubleshooting. (See Figure 4—3.)

4.14 To select the tests to be made on the lines under test, perform the following steps.

1. If detection of an open C lead fault is desired, engage the OPEN C-LEAD pushbutton.

2. If detection of false tip/ring polarity reversal during dialing is desired, engage the REV DRNG-DIAL pushbutton.

3. If detection of 1-kHz tone is desired, engage the 1KHZ TONE pushbutton. The 1-kHz tone source can be the analyzer's built-in test line or other source such as a type 102 test line. After engaging the 1KHZ TONE pushbutton, the DB controls must be set to establish acceptable upper and lower limits for the received level of 1-kHz tone. The DB controls can be set as follows.

a. Set EML control for the expected measured level (in — dBm) of detected 1-kHz tone. If the analyzer's internal test line is to be the source of 1-kHz tone, set the EML control for 0 dBm minus the estimated loss from telephone equipment.

NOTE

The expected level will be as selected by the EML control for both 600 and 900-ohm circuits.

b. Set LO-LIMIT control for the allowed (as determined by the user) negative deviation (in dB) from the EML control setting.

c. Set HI-LIMIT control for the allowed positive deviation (in dB) from the EML control setting.

4. If detection of answer supervision (tip/ring polarity reversal) is desired, engage the ANS SUP pushbutton.

5. If detection of a call completed to the unit's internal test line is desired, engage the INC CKT pushbutton. For this test, the rear panel INCOMING CIRCUIT terminals must connect to an incoming circuit as described in Section 3.

4.15 Any combination (or all) of the above tests can be selected. To record a TEST OK, **all** selected tests must be satisfied (no faults detected).

NOTE

To avoid a program error condition, at least one (or more) of the following pushbuttons must be engaged: 1KHZ TONE, ANS SUP, and INC CKT.

4.16 The analyzer can be made to halt automatic operation and hold the line under test for troubleshooting when a call completion failure is encountered. To select a HOLD ON program, perform the following steps.

1. Engage the HOLD ON REORDER pushbutton if interruption of automatic testing is desired when the unit detects reorder tone without false tip/ring polarity reversal (answer).

2. Engage the HOLD ON BUSY pushbutton if interruption of automatic testing is desired when the unit detects busy tone without false tip/ring polarity reversal (answer).

3. Engage the HOLD ON R OR B ANSWER pushbutton if interruption of automatic testing is desired when the unit detects false tip/ring polarity reversal (answer) and either reorder tone or busy tone.

4. Engage the HOLD ON FAULT pushbutton if interruption of automatic testing is desired when the unit detects any fault. A fault occurs when the test program is not satisfied or the unit detects a no dial tone (or no wink) fault. Busy and reorder conditions are not considered faults by the analyzer.

4.17 All, none, or any combination of the above described HOLD ON pushbuttons can be engaged. The HOLD ON MANUAL pushbutton is used only for manually holding the line under test and should initially be released.

NOTE

It is normal practice to select one or more HOLD ON conditions when the analyzer is used with the Model 4101 or 4101A Identifier.

4.18 SYSTEM TIMING PROGRAM

4.19 The analyzer's overall timing can be adjusted by the front panel SYSTEM TIMING controls to meet the requirements of the user. (See Figure 4—4.) Each of these controls are described in following paragraphs.

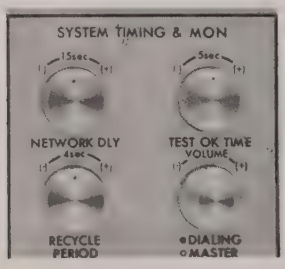


Figure 4—4. System Timing And Monitor Controls

4.20 The NETWORK DLY control sets the maximum time allowed to obtain a test OK after completion of dialing. The time can be set from approximately 2 to 60 seconds. If the test program is not satisfied and a busy or reorder tone is not detected during this time interval, a fault is recorded in the appropriate category. **A typical setting for this control is 15 seconds.**

4.21 The RECYCLE PERIOD control sets the minimum time the unit will be on-hook between test calls. The control permits adjustment from approximately 2 to 8 seconds. After this time period expires, the unit will begin the next test call if an idle line has been selected. **A typical setting for this control is 4 seconds.**

4.22 The TEST OK TIME control sets the minimum time a satisfactory test result must be present before a test OK can be recorded. This control can be set from approximately 2 to 8 seconds. **A typical setting is 5 seconds.**

4.23 The DIALING/MASTER VOLUME controls can be adjusted as desired while test calls are in progress. These controls should be initially set at midrange.

4.24 START DIAL PROGRAM

4.25 The start dial program determines the conditions that must be met before dialing can begin. Also, if the analyzer is programmed to pause one or more times during the dialing sequence (a WSD interval), the start dial program must be satisfied again before dialing can resume. (This allows proper operation with PBX's and other equipment requiring a pause in the dialing sequence.)

4.26 The possible start dial programs are of two general types: DELAY and DIAL TONE. A third, special start dial program is provided primarily for use with the Northeast Electronics Model 4101 or 4101A Identifier. Figure 4—5 shows the start dial controls.

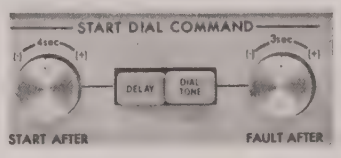


Figure 4—5. Start Dial Command Controls

4.27 Engaging the DELAY pushbutton conditions the analyzer to begin dialing after a preset time interval expires following initial off-hook. When a programmed WSD pause is encountered during the dialing, the same start-dial delay must expire before dialing can resume. The START AFTER control sets the start-dial delay from approximately 2 to 8 seconds. **A typical setting is 4 seconds.**

4.28 Engaging the DIAL TONE pushbutton conditions the analyzer to begin (or resume) dialing upon receipt of dial tone. The FAULT AFTER control setting determines the maximum time the unit will wait for dial tone.

If dial tone is not detected during the fault-after period, the test call is aborted, a no dial tone fault is recorded, and the NO DIAL TONE indicator lights. The FAULT AFTER control can be varied from approximately 1 to 7 seconds. **A typical setting is 3 seconds.**

4.29 On analyzer's equipped with multifrequency dialing, the function of the DIAL TONE pushbutton is expanded to include wink and similar start dial signals. Hence, dialing begins (or resumes) when either dial tone or wink is received. Specifically, either of the following is considered a valid start dial signal.

1. Dial tone.

2. A reversed tip/ring polarity (off-hook) present on the line under test for at least 128 milliseconds followed by a return to normal polarity (on-hook) that lasts for at least 128 milliseconds. The line under test can be in either the normal or reversed condition prior to seizure.

4.30 If an expected wink or similar start dial signal is not received during the fault-after delay period, the analyzer responds as described above for a no dial tone condition. Hence, the no dial tone fault category can contain no wink as well as no dial tone faults.

4.31 A special start dial program, provided primarily for use with the Model 4101 or 4101A Identifier, can be obtained by engaging both the DELAY and DIAL TONE pushbuttons. This program conditions the unit to: (a) begin dialing when dial tone (or wink) is received after initial off-hook, and if WSD commands are entered into the dialer, to (b) resume dialing after the START AFTER delay expires. (Detecting neither dial tone nor wink within the FAULT AFTER period after off-hook produces a no dial tone fault as described above.) This start dial program, in conjunction with the dialer program, ensures that the Identifier has sufficient time to transmit its recognition signal and should be selected under the following conditions.

1. The anlayzer is used with the Model 4101 or 4101A Identifier, and

2. It is desired to check for the presence of dial tone or wink, and

3. Dialing is to be either Touch-Tone or multifrequency.

NOTE

At least one of the START DIAL COMMAND pushbuttons must be engaged to avoid a program error condition. Also, if the previous instructions have been followed correctly, the PROGRAM ERROR message should not be displayed at this time.

4.32 PROGRAMMING THE DIALER

4.33 The analyzer's dialer program defines: (a) the number that wil be dialed, (b) the type of dialing (dial pulse, Touch-Tone, or multifrequency), and (c) certain dialing parameters. Figure 4—6 shows the dialer controls.

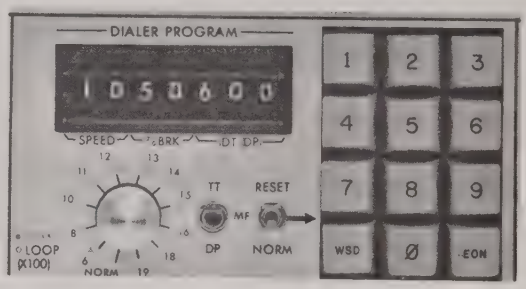


Figure 4—6. Dialer Controls

4.34 The number to be dialed should be the number necessary to reach a type 102 or other suitable test line. If the analyzer's built-in test line is to be used, the dialing number is the number for the incoming circuit connected to the analyzer's rear panel INCOMING CIRCUIT terminals. To enter the dialing number, place RESET/→/NORM switch to RESET then place to → (load). The number to be dialed can now be entered with the keyset.

4.35 If one or more wait-for-start-dial intervals (DIAL TONE or DELAY) are required between the digits of the dialing number, press the WSD key at the points in the dialing number where the waits should occur. For example, if the analyzer is to dial through PBX-type equipment to reach a central office, the WSD key is pressed after entering the digit necessary to obtain the second dial tone (usually the digit 9). Then the remainder of the number to be dialed can be entered.

4.36 If the analyzer is to be used with the Northeast Electronics Model 4101 or 4101A Identifier, **and** if it is determined that the special start dial program described in paragraph 4.31 is necessary, a WSD must be entered between the first and second digits of the dialing number. This conditions the analyzer to pause after dialing the first digit, thereby allowing the Identifier sufficient time to transmit its recognition signal.

4.37 After all digits of the number to be dialed are entered, press the EON (end-of-number) key and return

the RESET/→/NORM switch to NORM. The dialing digits should be displayed in the TEST PROGRESS readout at half brightness. (After each digit is dialed, it will be diplayed at full brightness.) The EON character and any WSD characters programmed are not displayed.

NOTE

The unit's dialer has a maximum capacity of 15 digits plus 1 EON character. However, each WSD character entered reduces the unit's numerical digit capacity by one. Also, only the first 11 numerical digits are displayed.

4.38 Either Touch-Tone, dial pulse or multifrequency dialing can be selected by setting the TT/DP/MF switch to the appropriate position. If this switch is set to MF on unit's not equipped with the multifrequency option, a program error condition will result.

NOTE

When a Model TTS 41-3A (equipped with the multifrequency option) is programmed to send MF signaling, the KP and ST tones will be transmitted automatically at the proper times.

4.39 The DIALER PROGRAM thumbwheel switch can be set as indicated in the following steps.

1. Set the SPEED thumbwheels of the DIALER PROGRAM switch for 1 to 99 pulses per second as desired if dial pulsing. **A typical setting is 12 pulses per second.** For Touch-Tone or multifrequency dialing, set the SPEED thumbwheels for 1 to 99 digits per second as desired. **A typical setting is 10 digits per second.**

2. Set the % BREAK thumbwheel of the DIALER PROGRAM switch for 1 to 99 percent break as desired if dial pulsing. **A typical setting is 60 percent break.** For Touch-Tone or multifrequency dialing, set the % BREAK thumbwheels for a duty cycle (tone on period) of 1 to 99 percent as desired. **A typical setting is 50 percent tone.**

3. Set the IDT thumbwheels of the DIALER PROGRAM switch for an interdigital time of 1 to 999 milliseconds as desired only if dial pulsing. **A typical setting is 600 milliseconds.** For Touch-Tone or multifrequency dialing, the IDT thumbwheels have no effect.

4.40 If dialing is to be DP, one of several values of leak impedance or loop resistance can be selected with the LEAK/LOOP switches. Leak impedance is a standardized impedance network shunted across the line under test during dial pulsing to simulate the effects of ringing bridges, senders, etc. Table 4—1 lists leak impedances that can be selected with the LEAK switch (inner knob), and gives application information for each network. If leak impedance is not desired, set the LEAK switch to NORM.

NOTE

Four resistive leak impedances are included in the unit. These are primarily used in routining Stromberg-Carlson X-Y offices.

Table 4—1. TTS 41-3A Leak Impedance Networks

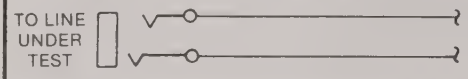
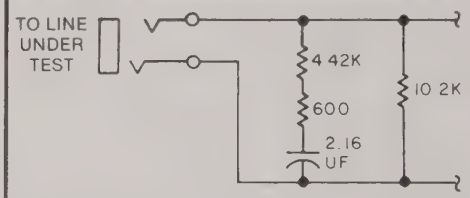
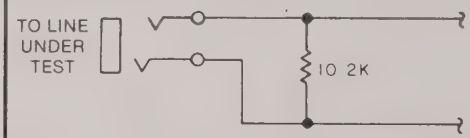
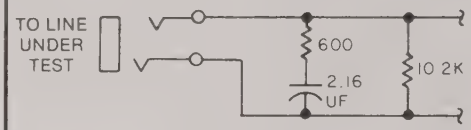
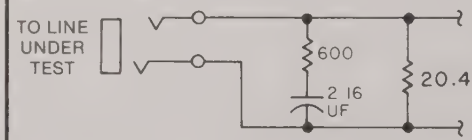
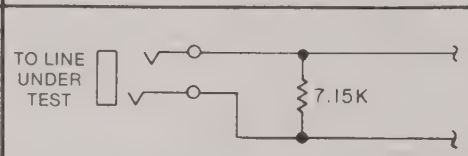
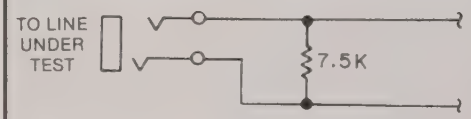
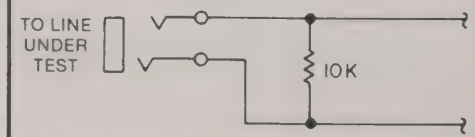
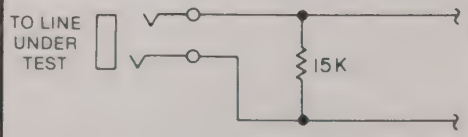
LEAK SWITCH SETTING	SCHEMATIC	SIMULATES	
NORM		Open circuit.	
A		A subscriber line near the central office equipped with five C4A ringing bridge extensions and a 15K-ohm leak on the drop wire.	
B		A sender output without contact protection and with a 10.2 -kohm leak.	
C		A circuit sender loop pulsing network with a 10.2- k ohm leak across the trunk.	
D		A sender output with a leak of 20.4 k ohms.	
7.15		A line with a 7.15-k ohm leak.	For Stromberg-Carlson X-Y Offices
7.5		A line with a 7.5-k ohm leak.	
10		A line with a 10-k ohm leak.	
15		A line with a 15-k ohm leak.	

Table 4—2. TTS 41-3A Loop Resistance Values

LOOP SWITCH POSITION	VALUE
N	< 1 ohm
6	600 ohms
8	800 ohms
10	1 kohms
11	1.1 kohms
12	1.2 kohms
13	1.3 kohms
14	1.4 kohms
15	1.5 kohms
16	1.6 kohms
18	1.8 kohms
19	1.9 kohms

4.41 Loop resistance is a resistance placed in series with the line under test during dial pulsing to simulate the effects of various loop lengths. Table 4—2 lists the loop resistance values that can be selected with the LOOP switch (outer knob). If loop resistance is not desired, set LOOP switch to NORM.

NOTE

It is not typical practice to use both leak impedance and loop resistance at the same time.

4.42 TESTING INSTRUCTIONS

4.43 After the analyzer is correctly programmed as described in the previous paragraphs, it can be applied to the desired routining task. The following is a logical procedure to begin testing operations.

ACTION	RESULT
1. To verify installation and programming of the analyzer, place MODE switch to SINGLE CALL.	Unit goes off-hook on the selected idle channel A or channel B line. If the start dial program is satisfied, the unit dials the stored number. The dialing signals (DP, TT, or MF) are heard as the number is dialed. The dialed digits appear in TEST PROGRESS readout at full brightness. Indicators in the TEST PROGRESS display show which operation the unit is currently performing. If the test program is satisfied, the TEST OK indicator lights and a count is placed in the test OK category. If a test selected by one of the engaged test program pushbuttons is not satisfied, a fault is recorded in the appropriate test results category, and the appropriate test results indicator lights. If the unit detects busy or reorder tone, a count is placed in the appropriate test results category and the appropriate indicator lights. The unit also determines if false tip/ring polarity reversal (answer) occurs with a busy or reorder tone. After the unit determines test results, it remains off-hook and the SYSTEM HELD indicator lights. An alarm tone is heard from the unit's speaker.
2. If analyzer did not perform as expected, set MODE switch to IDLE and recheck installation and programming. Repeat step 1 until proper operation is achieved.	

ACTION	RESULT
3. Adjust DIALING/MASTER VOLUME controls as desired. (The DIALING VOLUME control sets the volume only when unit is dialing.)	
4. Set MODE switch to AUTO.	Analyzer places a test call as described in step 1. After test results have been determined, the unit returns on-hook unless held off-hook by a HOLD ON program. NOTE If troubleshooting on a held line is desired, refer to paragraph 4.46. All test result indications are removed when the unit returns on-hook. The unit remains on-hook for a time determined by the RECYCLE PERIOD control. Then the unit goes off-hook to place another test call if another idle line has been found.
5. To remove unit from a SYSTEM HELD condition, momentarily place MODE switch to IDLE, then return to AUTO.	Unit resumes testing.
6. If manually holding the line under test is desired, engage the MANUAL pushbutton.	SYSTEM HELD indicator lights. Unit remains off-hook at the end of the current test cycle.
7. Release MANUAL pushbutton to resume automatic testing if this pushbutton was engaged previously.	Unit resumes testing.
8. Release the line under test and halt all testing at any time by setting MODE switch to IDLE.	IDLE indicator lights. Testing stops.

4.44 READING OUT TEST RESULTS

4.45 The TEST RESULTS readout normally displays the total number of tests performed. The counts stored for all other test result categories are displayed in the TEST RESULTS readout when the corresponding pushbuttons are pressed. (See Figure 4—7.) To reset all test result categories to zero (blank), press RESET pushbutton with MODE switch at IDLE.

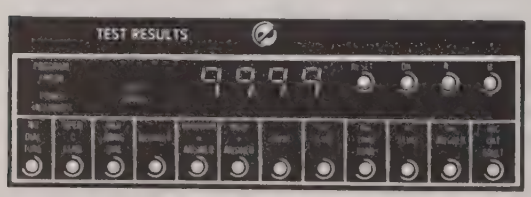


Figure 4—7. Test Results Controls And Indicators

4.46 TROUBLESHOOTING A CALL COMPLETION FAILURE

4.47 If the analyzer detects a call completion failure for which a HOLD ON pushbutton is engaged, the analyzer will halt automatic operation and hold (remain off-hook) the failed line for troubleshooting. An alarm tone will be heard at this time and the SYSTEM HELD message will be displayed. If an open C-lead condition occurs on the failed line, the analyzer automatically supplys up to approximately 180 mA sleeve current in an attempt to hold switched connections for troubleshooting.

4.48 When the unit is holding a failed line, all digits of the dialing number will be displayed at full brightness only if the entire number was succesfully dialed. If a fault occurred during the dialing period, only those digits successfully dialed will be displayed at full bright-

ness. Thus, a call completion failure detected during dialing can be pinpointed to a particular switching level by noting the relationship of half-bright to fully-bright digits on the TEST PROGRESS readout.

4.49 The analyzer will hold a failed line for troubleshooting as long as necessary. A held line can be released and testing resumed at any time by setting the MODE switch momentarily at IDLE then returning to AUTO.

4.50 The unit's trace feature can be used to aid in troubleshooting a call completion failure. For example, when a failure is encountered on channel A and the analyzer is holding the line, engaging the TRACE A pushbutton switches onto the failed line: (a) a distinctive tracing tone, and (b) a special holding circuit. This allows the unit's primary holding circuit to be used for testing on channel B while troubleshooting progresses on channel A. To resume testing on channel B (TEST B pushbutton must be engaged) while tracing and troubleshooting is in progress on channel A, momentarily set the MODE switch to IDLE then return to AUTO. It is not necessary to release the TEST A pushbutton.

4.51 Similarly, the engaged TRACE B pushbutton couples a tracing tone to a held channel B line and allows simultaneous troubleshooting on channel B while testing on channel A. The unit's tracing tone can be coupled to a held line as long as necessary. Normal, two-channel testing can resume only after both TRACE pushbuttons are released.

4.52 OVER RANGE INDICATION

4.53 Each test result category has a count capacity of 9999. The TOTAL TESTS category reaches this count first, and when this occurs, the OVER RANGE indicator lights. After any category goes over range, the count then continues in that category moving up again from zero. To remove the OVER RANGE indication, press the RESET pushbutton with MODE switch at IDLE. This action also resets all test result categories to zero.

4.54 POWER INTERRUPT INDICATION

4.55 This indicator flashes to indicate unit's power has been momentarily removed. The off (down) to ON transition of the POWER switch also causes this indicator to flash. When the power interrupt indication occurs, the PROGRAM ERROR indicator lights and the unit is held on-hook. To remove the power interrupt indication press RESET pushbutton for at least one second with MODE switch in IDLE position. The dialing number must be reprogrammed after a power interrupt occurs.

4.56 PROGRAM ERROR INDICATION

4.57 This message indicates that the analyzer is incorrectly programmed and hence, cannot operate. The unit is forced on-hook until all program errors are corrected. Possible program errors include the following.

1. The MODE switch is not at IDLE when RESET/→/NORM switch is set to RESET or → load.

2. Both the DELAY and DIAL TONE pushbuttons are released.

3. The ANS SUP, 1KHZ TONE, and INC CKT pushbuttons are all released.

4. Both the TEST A and TEST B pushbuttons are released.

5. The TT/DP/MF switch is set to MF on a unit not equipped with the multifrequency option.

6. A power interrupt condition exists.

4.58 **EXAMPLE APPLICATIONS**

4.59 The following paragraphs describe several example applications for the TTS 41-3A Service Analyzer. These applications show how the analyzer interconnects with telephone equipment to perform basic routining tasks. Although the actual analyzer program used for any application is determined by the user's requirements and the telephone equipment involved, typical programs for each application are described below.

4.60 ROUTINING A SXS CENTRAL OFFICE

4.61 The TTS 41-3A can routine a SXS central office with up to 1600 lines without changing the installation. Figure 4—8 shows the analyzer properly connected to telephone switching equipment to perform this task. As shown by Figure 4—8, test calls are placed to the analyzer's built-in test line so regular office test lines can be used for other purposes.

4.62 If the central office has less than 16 line finder groups, the lines under test should be evenly divided between channel A and channel B. This allows troubleshooting a held line on one channel, while testing is in progress on the other channel.

4.63 To routine a SXS central office, the analyzer can be programmed as described in the following steps.

1. Prepare the unit for use and make initial control settings as described in paragraph 4.4.

2. Set DB controls for an EML (expected measured level) of 0 dBm and low and high limits of 5 dB.

3. Set the DIALER PROGRAM thumbwheel switch for a dialing speed of 12 pps, percent break of 60%, and an IDT (interdigital time) of 600 milliseconds.

4. Set POWER switch to ON.

5. Press RESET pushbutton located in TEST RESULTS section of front panel for at least one second.

6. Engage the following pushbuttons:

a. TEST A,
b. TEST B,
c. DIAL TONE,
d. OPEN C-LEAD,
e. 1KHZ TONE,
f. INC CKT,
g. FAULT.

7. Set RESET/→/NORM switch to RESET, then to load (→).

8. Enter the number necessary to reach the analyzer's test line with the keyset. After the number to be dialed has been entered press the EON key.

9. Set RESET/→/NORM switch to NORM.

4.64 The program described in the previous paragraphs conditions the analyzer to do the following.

1. Alternate test calls between channel A and channel B.

2. Begin dialing after dial tone is detected.

3. Check for open circuit or battery on the sleeve lead of the line under test after dialing begins.

4. Determine if the analyzer's internal test line has been reached. When the internal test line is reached, 1-kHz tone from the test line is sent through the office switching equipment to the analyzer channel A or channel B line on which the test call was placed.

5. Check for the presence of 1-kHz tone on the channel A or channel B line under test at a level of 0 dBm ±5 dB. The expected level selected is 0 dBm for both 600 and 900-ohm circuits.

6. Halt all testing and remain off-hook on the line under test if the analyzer detects any of the faults described in the following paragraph.

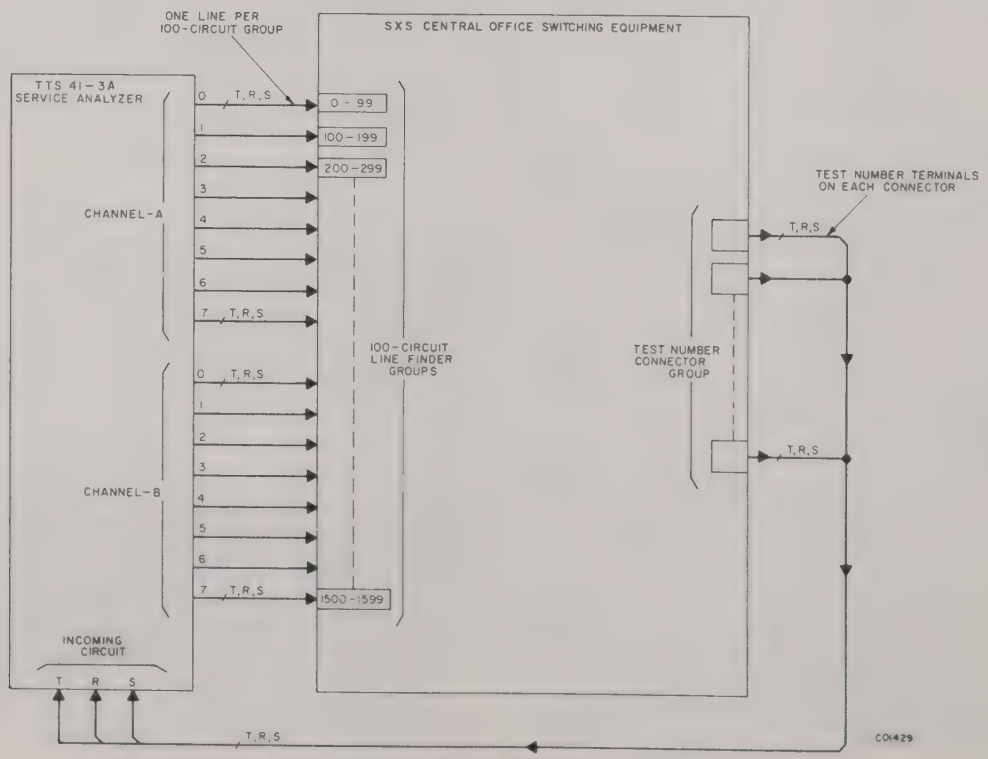


Figure 4—8. Routining A 1600-Line SXS Office

4.65 The program described previously conditions the analyzer to detect a fault if any of the following occur.

1. Dial tone is not detected within approximately 3 seconds (FAULT AFTER delay) after going off-hook.

2. The sleeve lead of the line under test is open circuit or more negative than −11V, after dialing begins. The analyzer automatically supplies up to 180 mA sleeve current in an attempt to hold switched connections for troubleshooting.

3. The internal test line is not reached within approximately 15 seconds (NETWORK delay) after dialing is completed. Refer to paragraph 3.19 for conditions necessary for call completion to the test line.

4. A 1-kHz tone is not present on the line under test at a level of 0 dBm ± 5 dB within approximately 15 seconds after dialing is completed.

4.66 To verify installation and programming, place a single test call by placing the MODE switch to SINGLE CALL. Adjust DIALING/MASTER VOLUME control as desired. If the analyzer did not perform as expected, return the MODE switch to IDLE and recheck installation and programming. After proper operation has been achieved, place MODE switch to AUTO to commence automatic testing.

4.67 If the analyzer detects a fault, an alarm will be heard and a lit message lamp shows the type of fault that occurred. The analyzer remains off-hook on the line under test and all testing stops. When this occurs, pressing the appropriate TRACE pushbutton will apply a tracing tone on the line under test for troubleshooting purposes. While troubleshooting with the trace tone on one channel, testing may be resumed on the other channel by momentarily placing the MODE switch to IDLE, then returning to AUTO.

4.68 As each test call is placed, the TEST RESULTS readout increments to indicate the total number of all calls attempted. The counts stored for other test result categories are displayed in the TEST RESULTS readout when the appropriate pushbuttons are pressed. Refer to Table 4−3 for a description of each test result category.

4.69 To release the line under test and halt all testing at any time, set the MODE switch to IDLE.

4.70 ROUTINING OUTGOING TRUNKS

4.71 This application describes routining outgoing loop trunks requiring dial pulse dialing, an operation that can be performed by any Model TTS 41-3A. Where multifrequency dialing is required, the analyzer must be equipped with the multifrequency option. (An application involving the multifrequency option is given later in this section.) The Model TTS 41-3A cannot be used on 4-wire trunks.

4.72 The analyzer can be connected to outgoing trunks as shown in Figure 4−9. If less than 16 trunks are to be tested, they should be evenly divided between channel A and channel B. This allows troubleshooting a held line on one channel, while testing progresses on the other channel.

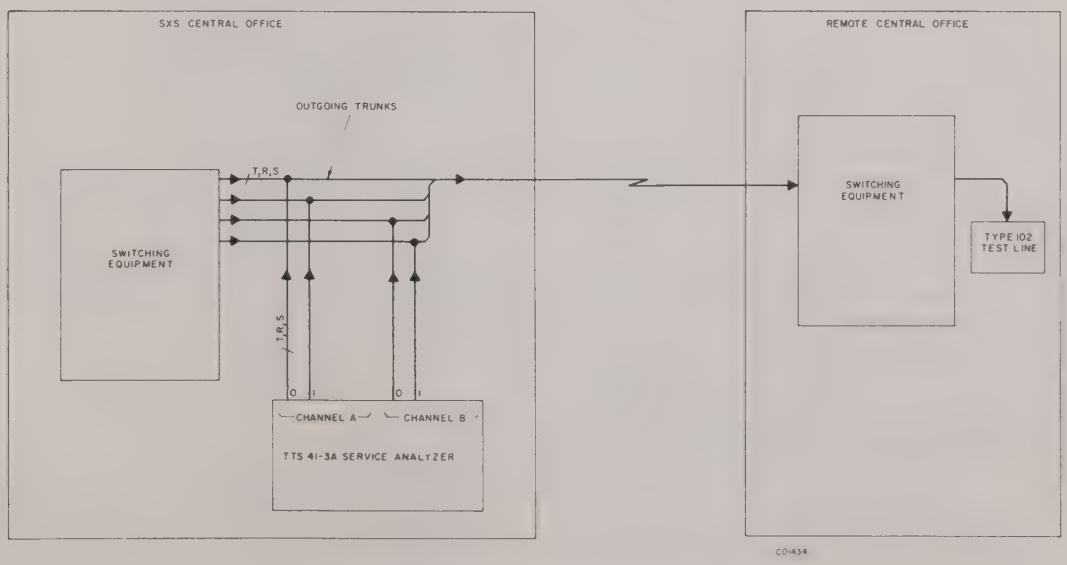


Figure 4−9. Routining Outgoing Trunks

4.73 To routine outgoing trunks, the analyzer can be programmed as described in the following steps.

1. Prepare the unit for use and make initial control settings as described in paragraph 4.4.

2. Set the DB controls for an EML (expected measured level) of 0 dBm minus the estimated loss in the outgoing trunks, and low and high limits of 5 dB.

3. Set the DIALER PROGRAM thumbwheel switch for a dialing speed of 12 pps, percent break of 60%, and IDT (interdigital time) of 600 milliseconds.

4. Set POWER switch to ON.

5. Press RESET pushbutton located in TEST RESULTS section of the front panel.

6. Engage the following pushbuttons:

   a. TEST A,
   b. TEST B,
   c. DELAY,
   d. ANS SUP,
   e. 1KHZ TONE.

7. Set RESET/→/NORM switch to RESET, then to load (→).

8. Use the keyset to enter the number necessary to reach a source of 1-kHz tone (such as a type 102 test line) located at the far end of outgoing trunks. After the number to be dialed has been entered press the EON key.

9. Set RESET/→/NORM switch to NORM.

4.74 The program described in the previous paragraph conditions the analyzer to do the following.

1. Alternately check channel A and channel B for trunks that are idle (sleeve lead open circuit or more negative than −11V). The analyzer goes off-hook when an idle trunk is selected.

2. Begin dialing approximately 4 seconds (START AFTER delay) after going off-hook.

3. Check for the presence of 1-kHz tone on the trunk under test at a level within the range determined by settings of the DB controls. The expected level is as selected by the EML control for both 600 and 900-ohm circuits.

4. Check for presence of answer supervision (tip/ring reversal) after dialing is completed.

5. Continue testing after the analyzer detects a fault.

4.75 The program described previously for routining outgoing trunks conditions the analyzer to detect a fault if either of the following occur:

1. A 1-kHz tone is not present on the trunk under test within approximately 15 seconds (NETWORK delay) after dialing is completed. The 1-kHz tone must also be detected at a level that is within the range determined by DB control settings to avoid a fault.

2. Answer supervision is not detected within approximately 15 seconds after dialing is completed.

4.76 To verify installation and programming, place a single test call by placing the MODE switch to SINGLE CALL. Adjust DIALING/MASTER VOLUME control as desired. If the analyzer did not perform as expected, return the MODE switch to IDLE and recheck installation and programming. After proper operation has been achieved, place MODE switch to AUTO to commence automatic testing.

4.77 As each test call is placed, the TEST RESULTS readout increments to indicate the total of all calls attempted. The counts stored for other test result categories are displayed in the TEST RESULTS readout when the appropriate pushbuttons are pressed. Refer to Table 4−3 for a description of each test result category.

4.78 To release the line under test and halt all testing at any time, set MODE switch to IDLE.

4.79 USING THE MULTIFREQUENCY OPTION TO ROUTINE INCOMING TRUNKS

4.80 This application describes routining incoming loop trunks requiring multifrequency dialing. Figure 4−10 shows the analyzer properly connected to incoming trunks. If less than 16 trunks are to be tested, they should be evenly divided between channel A and channel B. This allows troubleshooting a held line on one channel, while testing progresses on the other channel.

NOTE

Analyzers without the multifrequency option are limited to operation on trunks requiring dial pulsing.

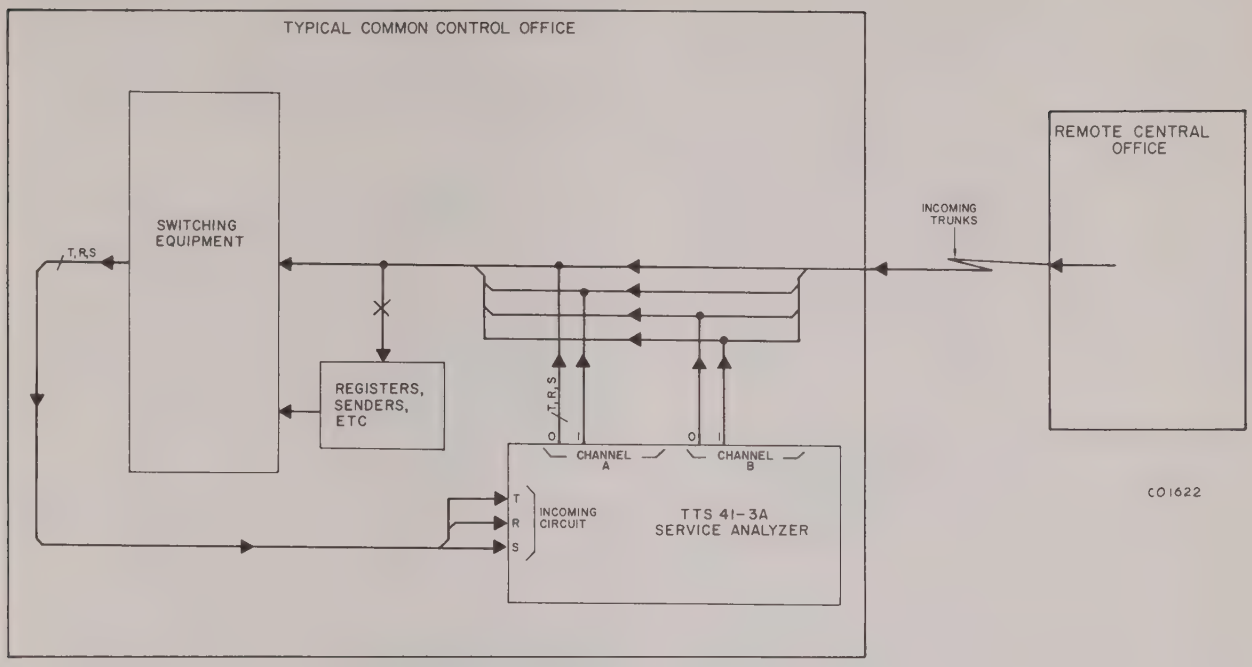


Figure 4—10. Routining Incoming Trunks

4.81 To routine incoming trunks, the analyzer can be programmed as described in the following steps.

1. Prepare the unit for use and make initial control settings as described in paragraph 4.4.

2. Set DB controls for an EML (expected measured level) of 0 dBm and low and high limits of 5 dB.

3. Set the DIALER PROGRAM thumbwheel switch for a dialing speed of 10 digits per second, and a percent tone (% BRK digits) of 50%. The IDT thumbwheels are not used in this application.

4. Set TT/DP/MF switch to MF.

5. Set POWER switch to ON.

6. Press RESET pushbutton located in TEST RESULTS section of front panel for at least one second.

7. Engage the following pushbuttons:

   a. TEST A,
   b. TEST B,
   c. DIAL TONE (programs detection of wink),
   d. ANS SUP,
   e. 1KHZ TONE,
   f. INC CKT,
   g. FAULT.

8. Set RESET/→/NORM switch to RESET, then to load (→).

9. Use analyzer's keyset to enter the number necessary to reach the analyzer's test line. After the number to be dialed has been entered, press the EON key.

10. Set RESET/→/NORM switch to NORM.

4.82 The program described in the previous paragraph conditions the analyzer to do the following.

1. Alternately check channel A and channel B for trunks that are idle (sleeve lead open circuit or more negative than −11V.) The analyzer goes off-hook when an idle trunk is selected.

2. Begin multifrequency dialing after a wink or similar start dial signal (off-hook to on-hook tip/ring reversal) is detected.

3. Transmit the KP and ST signals at the proper times.

4. Check for presence of answer supervision (tip/ring reversal) after dialing is completed.

5. Determine if the analyzer's internal test line has been reached. When the internal test line is reached, 1-kHz tone from the test line is sent through the office switching equipment to the analyzer channel A or channel B line on which the test call was placed.

6. Check for the presence of 1-kHz tone on the trunk under test at a level of 0 dBm ±5 dB. The expected level selected is 0 dBm for both 600 and 900-ohm circuits.

7. Halt all testing and remain off-hook on the trunk under test if the analyzer detects any of the faults described in the following paragraph.

4.83 The program described previously conditions the analyzer to detect a fault if any of the following occur.

1. A wink or similar start dial signal is not detected within approximately 3 seconds (FAULT AFTER delay) after going off-hook.

2. Answer supervision is not detected within approximately 15 seconds (NETWORK delay) after dialing is completed.

3. The internal test line is not reached within approximately 15 seconds after dialing is completed. Refer to paragraph 3.19 for conditions necessary for call completion to the test line.

4. A 1-kHz tone is not present on the trunk under test at a level of 0 dBm ± 5 dB within approximately 15 seconds after dialing is completed.

4.84 To verify installation and programming, place a single test call by placing the MODE switch to SINGLE CALL. Adjust DIALING/MASTER VOLUME control as desired. If the analyzer did not perform as expected, return the MODE switch to IDLE and recheck installation and programming. After proper operation has been achieved, place MODE switch to AUTO to commence automatic testing.

4.85 If the analyzer detects a fault, an alarm will be heard and a lit message lamp shows the type of fault that occurred. The analyzer remains off-hook on the line under test and all testing stops. When this occurs, pressing the appropriate TRACE pushbutton will apply a tracing tone on the line under test for troubleshooting purposes. While troubleshooting with the trace tone on one channel, testing may be resumed on the other channel by momentarily placing the MODE switch to IDLE, then returning to AUTO.

4.86 As each test call is placed, the TEST RESULTS readout increments to indicate the total number of all calls attempted. The counts stored for other test result categories are displayed in the TEST RESULTS readout when the appropriate pushbuttons are pressed. Refer to Table 4—3 for a description of each test result category.

4.87 To release the line under test and halt all testing at any time, set MODE switch to IDLE.

4.88 ROUTINING PBX TRUNKS

4.89 The TTS 41-3A can routing PBX trunks via the switching equipment in a private branch exchange. Figure 4—11 shows the analyzer properly connected to PBX equipment to perform this task. The PBX in this example is assumed to be a SXS-type or similar type requiring dial pulsing.

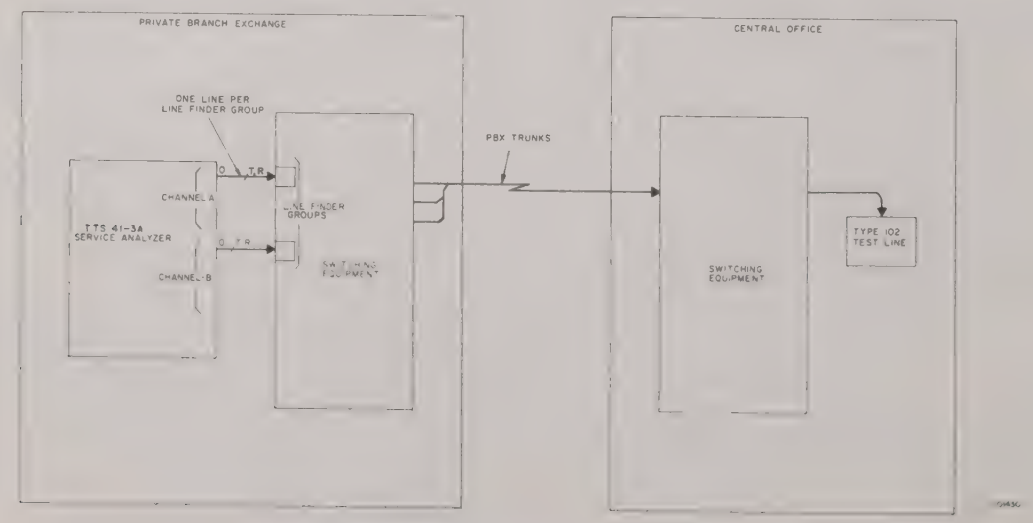


Figure 4—11. Routining PBX Trunks

4.90 If the PBX has less than 16 line finder groups, the lines under test should be evenly divided between channel A and channel B. This allows troubleshooting on a held line on one channel while testing is in progress on the other channel.

4.91 To routine PBX trunks, the analyzer can be programmed as described in the following steps.

1. Prepare the unit for use and make initial control settings as described in paragraph 4.4.

2. Set DB controls for an EML (expected measured level) of 0 dBm minus the estimated loss in the PBX trunks under test, and low and high limits of 5 dB.

3. Set the DIALER PROGRAM thumbwheel switch for a dialing speed of 12 pps, percent break of 60%, and an IDT (interdigital time) of 600 milliseconds.

4. Set POWER switch to ON.

5. Press RESET pushbutton located in TEST RESULTS section of front panel for at least one second.

6. Engage the following pushbuttons:

   a. TEST A,
   b. TEST B,
   c. DIAL TONE,
   d. REV DRNG-DIAL,
   e. 1KHZ TONE.

7. Set RESET/→/NORM switch to RESET, then to load (→).

8. Use the keyset to enter the digit required by the PBX switching equipment to obtain the second dial tone (usually the digit 9). Press the WSD key, then enter the number necessary to reach a source of 1-kHz tone (such as a type 102 test line) located in the serving central office. After the number to be dialed has been entered press the EON key.

9. Set RESET/→/NORM switch to NORM.

4.92 The program described in the previous paragraph conditions the analyzer to do the following.

1. Alternate test calls between channel A and channel B.

2. Dial the first digit after dial tone is detected, then wait for an additional dial tone before resuming the dialing.

3. Check for a false tip/ring polarity reversal during the dialing process. This condition discloses reversed wipers in SXS switch trains.

4. Check for the presence of 1-kHz tone on the PBX trunk under test at a level within the range determined by the settings of the DB controls. The expected level is as selected by the EML control for both 600 and 900-ohm circuits.

5. Continue testing after the analyzer detects a fault.

4.93 The program described previously for routining PBX trunks conditions the analyzer to detect a fault if any of the following occur.

1. Dial tone is not detected within approximately 3 seconds (FAULT AFTER delay) after going off-hook or within approximately 3 seconds after the first digit is dialed.

2. A false tip/ring reversal is detected during dialing.

3. A 1-kHz tone is not present on the PBX trunk under test within approximately 15 seconds (NETWORK delay) after dialing is completed. The 1-kHz tone must also be detected at a level that is within the range determined by DB control settings to avoid a fault.

4.94 To verify installation and programming, place a single test call by placing the MODE switch to SINGLE CALL. Adjust DIALING/MASTER VOLUME control as desired. If the analyzer did not perform as expected, return the MODE switch to IDLE and recheck installation and programming. After proper operation has been achieved, place MODE switch to AUTO to commence automatic testing.

4.95 As each test call is placed, the TEST RESULTS readout increments to indicate the total of all calls attempted. The counts stored for other test result categories are displayed in the TEST RESULTS readout when the appropriate pushbuttons are pressed. Refer to Table 4—3 for a description of each test result category.

4.96 To release the line under test and halt all testing at any time, set MODE switch to IDLE.

4.97 ROUTINING AND IDENTIFYING ORIGINATING REGISTERS IN A #5 X-BAR OFFICE

4.98 The Model 41-3A, in conjunction with the Northeast Electronics Model 4101A Identifier, can routine originating registers in a number 5 crossbar office and identify which originating register was used for each test call. To perform these operations, the Model 41-3A and 4101A should be installed as shown in Figure 4—12.

4.99 The analyzer's call origination lines should **not** include a sleeve lead. If less than 16 call origination lines are used, evenly distribute the lines between channel A and channel B. This allows troubleshooting a held line on one channel, while testing progresses on the other channel. Connect input power and sense lines to the Model 4101A Identifier as described in the Identifier's instruction manual

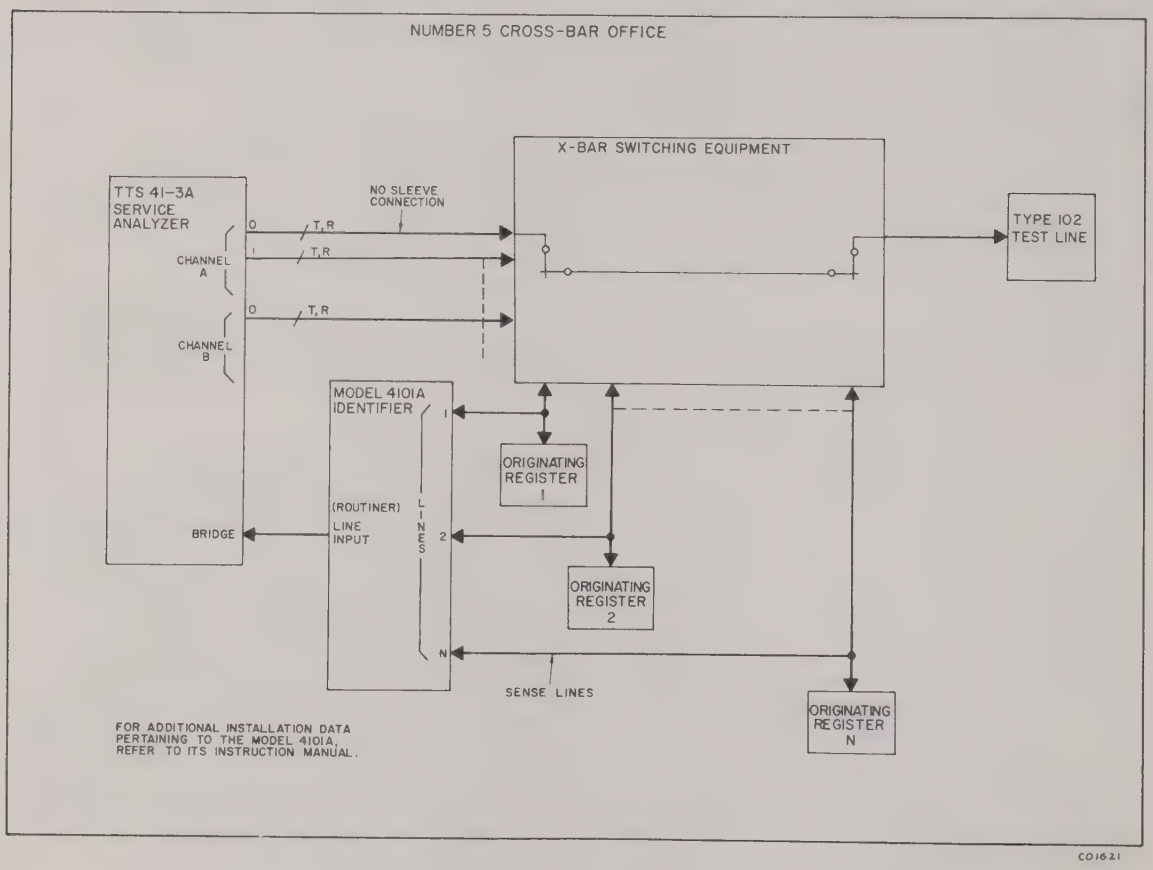


Figure 4—12. Routining And Identifying Originating Registers In A #5 X-Bar Office

4.100 The originating registers considered in this application are assumed to incorporate Touch-Tone receivers/translators. That is, Touch-Tone dialing is required for the routining operation.

4.101 To routine originating registers, the analyzer can be programmed as described in the following steps.

1. Prepare the unit for use and make initial control settings as described in paragraph 4.4.

2. Set DB controls for an EML (expected measured level) of 0 dBm and low and high limits of 5 dB.

3. Set the DIALER PROGRAM thumbwheel switch for a dialing speed of 10 digits per second, and a percent tone (% BRK digits) of 50%. The IDT thumbwheels are not used in this application.

4. Set TT/DP/MF switch to TT.

5. Set POWER switch to ON.

6. Press RESET pushbutton located in TEST RESULTS section of front panel for at least one second.

7. Engage the following pushbuttons:

   a. TEST A,
   b. TEST B,
   c. DELAY,
   d. DIAL TONE,
   e. 1KHZ TONE,
   f. FAULT.

8. Set RESET/→/NORM switch to RESET, then to load (→).

9. Use the keyset to enter the first digit of the number required to reach a 1-kHz tone source such as a type 102 test line. Press the WSD key, then enter the remaining digits of the number to be dialed. After the dialing number has been entered press the EON key.

10. Set RESET/→/NORM switch to NORM.

4.102 The program described in the previous paragraph conditions the analyzer to do the following.

1. Alternate test calls between channel A and channel B.

2. Dial the first digit after dial tone is detected, then wait for 4 seconds (START AFTER delay) before resuming the dialing. The 4-second pause allows the Identifier sufficient time to transmit its recognition signal. (If dial pulsing is selected the additional wait-for-start-dial period is unnecessary.)

3. Check for the presence of 1-kHz tone on the channel A or channel B line under test at a level of 0 dBm ±5 dB. The expected level selected is 0 dBm for both 600 and 900-ohm circuits.

4. Halt all testing and remain off-hook on the line under test if the analyzer detects faults.

4.103 The program described previously for routining originating registers conditions the analyzer to detect a fault if either of the following occur.

1. Dial tone is not detected within approximately 3 seconds (FAULT AFTER delay) after going off-hook.

2. A 1-kHz tone is not present on the line under test at a level of 0 dBm ± 5 dB within approximately 15 seconds (NETWORK delay) after dialing is completed.

4.104 When the analyzer stops testing due to a NO 1KHZ TONE fault, the Model 4101A will display the number of the originating register involved in the failed call.

4.105 Operate the Model 4101A according to information given in its instruction manual. To verify installation and programming of the analyzer, place a single test call by placing the MODE switch to SINGLE CALL. Adjust DIALING/MASTER VOLUME controls as desired.

4.106 As the analyzer places the single test call, the Model 4101A should display the number of the originating register that is receiving the dialed digits. If the analyzer (or the Model 4101A) does not perform as expected, return MODE switch to IDLE and recheck installation and programming. After proper operation has been achieved, place MODE switch to AUTO to commence automatic testing.

4.107 If the analyzer detects a fault, an alarm will be heard and a lit message lamp shows the type of fault that occurred. The analyzer remains off-hook on the line under test and all testing stops. When this occurs, pressing the appropriate TRACE pushbutton will apply a tracing tone on the line under test for troubleshooting purposes. The Model 4101A can be used to identify the originating register involved in the failed call. While the troubleshooting on one channel is in progress, testing may be resumed on the other channel by momentarily placing the MODE switch to IDLE, then returning to AUTO.

4.108 As each test call is placed, the TEST RESULTS readout increments to indicate the total number of all calls attempted. The counts stored for other test result categories are displayed in the TEST RESULTS readout when the appropriate pushbuttons are pressed. Refer to Table 4—3 for a description of each test result category.

4.109 To release the line under test and halt all testing at any time, set MODE switch to IDLE.

4.110 CONTROLS AND INDICATORS

4.111 The functions of all front panel and rear panel controls, indicators, and connectors are described in Table 4—3. The front panel controls, indicators, and connectors are identified on Figure 4—13. Figure 4—14 identifies rear panel controls and connectors.

Table 4—3. Controls, Indicators, And Connectors

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
POWER/LINE CONTROL GROUP		
J12/J13	52A	Allows use of a 52A headset for voice communication on selected line (if TALK pushbutton is engaged).
J14	A	For convenience, allows front panel connection of a single originating line (T/R or T/R/S) to the unit's channel A. The rear panel jack field is automatically disconnected when the A jack is used.
J15	B	For convenience, allows front panel connection of a single originating line (T/R or T/R/S) to the unit's channel B. The rear panel jack field is automatically disconnected when the B jack is used.
J16	BRIDGE	Allows T/R/S bridging connections to the selected call originating line. The line's internal connections to detection, holding and dialing circuits are not broken when the BRIDGE jack is used. NOTE Making level measurements (or similar tests) with external equipment via the BRIDGE jack is not recommended since the analyzer's 735-ohm termination will affect the results. The EXT jack can be used for this purpose as described in paragraph 4.112.
J17	EXT	Allows T/R/S terminating connections to the selected call originating line (only when EXT pushbutton is engaged). Engaged EXT pushbutton S7 breaks the line's internal connections to detection, holding and dialing circuits. The EXT pushbutton is a break-before-make type. To use the EXT jack with external test equipment without releasing the line under test, refer to paragraph 4.112.
M1	LINE CONTROL	Indicates dc voltage of normal or reverse polarity present on the selected call originating line.

Table 4—3. (cont'd)

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
S1	POWER	ON position applies ac power to the unit.
S2	TALK	When engaged, allows a 52A headset to be used for voice communication on the selected call originating line. The 52A headset connects to the 52A jacks. Engaged TALK switch S2 disables the monitor amplifier.
S3	TRACE A	When engaged, places a trace tone on a selected channel A line and holds the line off-hook. Engaged TRACE A pushbutton S3 disables operation of the channel A line selector and lights the TRACE A indicator. Engaged TRACE A pushbutton S3 does not inhibit tests on channel B.
S4	TEST A	When engaged, programs the unit to perform tests on channel A.
S5	TEST B	When engaged, programs the unit to perform tests on channel B. NOTE If both TEST pushbuttons are engaged and all lines are idle, test calls will alternate between channel A and channel B. (Busy lines and empty rear panel circuit selector jacks are automatically bypassed). Also, at least one TEST pushbutton must be engaged to avoid a program error condition.
S6	TRACE B	When engaged, places a trace tone on a selected channel B line and holds the line off-hook. Engaged TRACE B pushbutton S6 disables operation of the channel B line selector and lights the TRACE B indicator. Engaged TRACE B pushbutton S6 does not inhibit tests on channel A.
S7	EXT	When engaged, connects the EXT jack to the selected call originating line. Engaged EXT pushbutton S7 breaks the line's internal connections to detection/dialing/holding circuits, and presents the EXT jack to the line in a terminating configuration. Switching is break-before-make type.

Table 4—3. (cont'd)

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
DIALER GROUP		
S41	TT/DP/MF	Selects Touch-Tone dialing when placed in the TT position. Selects dial pulsing when placed in the DP position. The MF position selects multifrequency dialing only on units equipped with this option. Placing this switch at MF on a unit not equipped with the multifrequency option, results in a program error condition.
S42	RESET/→/NORM	When at RESET, blanks TEST PROGRESS readout U3-U13 except when unit is off-hook. The →(load) position enables entering of a number to be dialed via the keyset. Both the RESET and → (load) positions result in a program error unless MODE switch is at IDLE. The NORM position allows the MODE switch to be moved from IDLE without producing a program error.
S43	LEAK/LOOP	Sets leak impedance and loop resistance for dial pulsing. The LEAK (inner) control selects the leak impedance to be shunted across the line under test during dial pulsing. The LOOP (outer) control selects a loop resistance to be placed in series with the line under test during dial pulsing. Tables 4—1 and 4—2 list the values of leak impedance and loop resistance that can be selected with the LEAK/LOOP control. NOTE It is not typical practice to use both leak impedance and loop resistance at the same time.
S44	DIALER PROGRAM	The SPEED thumbwheels set (from 1 to 99) the number of pulses per second for dial pusling, or the number of digits per second for Touch-Tone or multifrequency dialing. The % BRK thumbwheels set (from 1 to 99) the percent break for dial pulsing or the duty cycle (tone-on period) for Touch-Tone or multifrequency dialing. The IDT thumbwheels set the interdigital time from 1 to 999 milliseconds for dial pulsing only.
S45	Keyset	Allows entry of a number to be dialed, but only when RESET/→/NORM switch is at → (load). The WSD (wait-for-start-dial) key may be used to program waits for additional dial tone (or optional wink) or start dial delay between any digits of the number to be dialed. The EON (end-of-number) key must be pressed after entering all digits of the number to be dialed.

Table 4—3. (cont'd)

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
SYSTEM TIMING/MODE GROUP		
R3	NETWORK DLY	Sets the maximum time allowed to obtain a test OK indication from approximately 2 to 60 seconds after completion of dialing. Faults are recorded in the appropriate test categories if the test program is not satisfied and a busy or reorder tone is not detected during this time interval. This control is typically set for 15 seconds.
R4	TEST OK TIME	Sets the minimum time duration that a satisfactory test result must be present before a test OK is recorded. Can be set from approximatley 2 to 8 seconds. This control is typically set for 5 seconds.
R5	RECYCLE PERIOD	Sets the minimum time period the unit will be on-hook between test calls. RECYCLE PERIOD can be set for 2 to 8 seconds and is typically set for 4 seconds.
R6	DIALING/MASTER VOLUME	MASTER (outer) control sets monitor output volume at all times except when unit is dialing, or on-hook, or when a 52A headset is in use. DIALING (inner) controls sets monitor output volume when unit is dialing. Monitor output is disabled when a 52A headset is in use or when unit is on-hook.
S40	MODE	IDLE position places the unit on-hook and lights the IDLE indicator. AUTO position allows repetitive test calling as programmed, except when a system hold is encountered. SINGLE CALL position, instructs the unit to remain off-hook (a system hold) after placing a single test call. To avoid a program error when MODE switch is moved from IDLE position, the RESET/→/ NORM switch must be in the NORM position.
START DIAL GROUP		
R1	START AFTER	Sets time period that unit will wait before dialing begins. Can be set from approximately 2 to 8 seconds. The wait will occur only if the DELAY pushbutton is engaged. The START AFTER control is typically set for 4 seconds.

Table 4—3. (cont'd)

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
R2	FAULT AFTER	Varies the maximum time allowed for detection of dial tone (or wink-type start dial signal on units with multifrequency option). If dial tone (or wink) is detected during FAULT AFTER period, dialing begins immediately. If neither dial tone nor wink is detected during this period, a no dial tone fault is recorded and the NO DIAL TONE indicator lights. To enable the dial tone/wink start dial function, the DIAL TONE pushbutton must be engaged. The FAULT AFTER control is typically set for 3 seconds and can be varied from approximately 1 to 7 seconds.
S9	DELAY	When engaged, programs the unit to wait for the START AFTER control delay to expire before dialing.
S10	DIAL TONE	On basic TTS 41-3A units, this pushbutton, when engaged, programs the analyzer to wait for dial tone before dialing. On units with the multifrequency option, the engaged DIAL TONE pushbutton programs the unit to wait for either dial tone or a wink-type start dial signal before dialing. (Refer to paragraph 4.29 for the start dial signals recognized by units equipped with multifrequency dialing.) The analyzer will wait for dial tone (or wink) for a maximum time determined by the FAULT AFTER setting. If a valid start dial signal is not detected during the FAULT AFTER period, a no dial tone fault is recorded and the NO DIAL TONE indicator lights. NOTE Both the DELAY and DIAL TONE pushbuttons can be engaged when desired. This program conditions the unit to: (a) begin dialing when dial tone (or wink) is received after initial off-hook, and if WSD commands are entered into the dialer, to (b) resume dialing after the START AFTER delay expires. (Detecting neither dial tone nor wink within time allowed after initial off-hook produces a no dial tone fault.) Also, at least one of the START DIAL COMMAND pushbuttons must be engaged to avoid a program error.

Table 4—3. (cont'd)

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
TEST PROGRAM GROUP		
S11	OPEN C-LEAD	When engaged, programs the unit to record an open C-lead fault and light the OPEN "C" LEAD indicator if an open C-lead is detected.
S12	REV DRNG-DIAL	When engaged, programs the unit to record as a fault any tip/ring polarity reversal which occurs during dialing. The REV DRNG DIAL indicator lights if the unit detects this condition.
S13	LO-LIMIT	Sets the minimum accpetable level of a detected 1-kHz tone with respect to programmed EML (S14). If the level of a detected 1-kHz tone is less than the EML setting by an amount greater than the LO-LIMIT setting (in dB), a low level fault is recorded and the LO-LEVEL indicator lights. The 1KHZ TONE pushbutton must be engaged to enable this function.
S14	EML	Sets the expected measured level (in — dBm) of a 1-kHz tone to be detected. If a detected 1-kHz tone varies from the EML setting by an amount outside upper and lower limits (set by LO-LIMIT S13 and HI-LIMIT S15) a fault is recorded in the appropriate category and the appropriate indicator lights. If no 1-kHz tone above −31 dBm is detected during NETWORK DLY (R3) time period following dialing, then the NO 1KHZ TONE message lights and the fault is recorded. The 1KHZ TONE pushbutton must be engaged to enable this function. NOTE The expected level will be as selected by the EML control for both 600 and 900-ohm circuits.
S15	HI-LIMIT	Sets the maximum acceptable level of a detected 1-kHz tone with respect to programmed EML (S14). If a detected 1-kHz tone exceeds the EML setting by an amount greater than the HI-LIMIT setting (in dB), a high level fault is recorded and the HI LEVEL indicator lights. The 1KHZ TONE pushbutton must be engaged to enable this function.
S16	1KHZ TONE	When engaged, programs the unit to record a no 1-kHz tone fault and light NO 1KHZ TONE indicator if the unit fails to detect a 1-kHz tone within the NETWORK DLY (R3) time period after dialing. The level of a 1-kHz tone must be greater than −31 dBm (from either 600 or 900-ohms) to be detected.

Table 4—3. (cont'd)

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
		The unit also determines if the 1-kHz tone level varies from the EML control S14 setting by an amount outside upper and lower limits set by LO-LIMIT control S13 and HI-LIMIT control S15. If either limit is exceeded, an appropriate fault is recorded and the corresponding indicator lights.
S17	ANS SUP	When engaged, programs the unit to record a no answer fault and to light the NO ANSWER indicator if tip/ring polarity reversal (answer) did not occur within the NETWORK DLY (R3) time period after dialing.
S18	INC CKT	When engaged, programs the unit to receive a test call via its internal test line. If the internal test line fails to detect a call within the NETWORK DLY (R3) time period after dialing, then an incoming circuit fault is recorded and the INC CKT FAULT indicator lights. NOTE At least one of the following switches must be engaged to avoid a program error: 1KHZ TONE S16, ANS SUP S17, and INC CKT S18.
S19	HOLD ON REORDER	When engaged, will cause unit to stop automatic recycling and remain off-hook if reorder tone is detected and false tip/ring polarity reversal (answer) is not detected. Both REORDER and SYSTEM HELD indicators light when this condition occurs.
S20	HOLD ON BUSY	When engaged, will cause unit to stop automatic recycling and remain off-hook if busy tone is detected and false tip/ring polarity reversal (answer) is not detected. Both BUSY and SYSTEM HELD indicators light when this condition occurs.
S21	HOLD ON R OR B + ANSWER	When engaged, will cause unit to stop automatic recycling and remain off-hook if false tip/ring polarity reversal (answer) is detected and either busy or reorder tone is also detected. SYSTEM HELD indicator and either REORDER + ANSWER indicator or BUSY + ANSWER indicator will light when this condition occurs.
S22	HOLD ON FAULT	When engaged, will cause the unit to stop automatic recycling and remain off-hook if any fault (not busy or reorder tone) is detected. The SYSTEM HELD indicator and the appropriate fault indicator will light when this condition occurs.

Table 4—3. (cont'd)

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
S23	HOLD ON MANUAL	When engaged, will cause the unit to stop automatic recycling and remain off-hook after completing the current test. The SYSTEM HELD indicator lights when this pushbutton is engaged. Also, the unit's alarm tone is disabled if a HOLD ON MANUAL is selected.
LINE DISPOSITION GROUP		
CR64	TEST A	Lights to indicate unit has gone off-hook after selecting an idle channel A line.
CR66	TEST B	Lights to indicate unit has gone off-hook after selecting an idle channel B line.
CR67	IDLE A	When lit indicates the selected channel A line is idle. (Sleeve lead open circuit or more negative then −11V.)
CR68	IDLE B	When lit indicates the selected channel B line is idle. (Sleeve lead open circuit or more negative than −11V.)
CR69, 70	TRACE A	Lights when the TRACE A pushbutton is pressed. Indicates a tracing signal is present on the selected channel A line.
CR71, 72	TRACE B	Lights when the TRACE B pushbutton is pressed. Indicates a tracing tone is present on the selected channel B line.
CR73	BUSY A	When lit indicates the selected channel A line is busy. (Sleeve lead at ground potential or more positive than −7V.)
CR74	BUSY B	When lit indicates the selected channel B line is busy. (Sleeve lead at ground potential or more positive than −7V.)
U1	CHAN A	Indicates the number of the selected channel A line.
U2	CHAN B	Indicates the number of the selected channel B line.
TEST PROGRESS GROUP		
CR33-38	INTER-DIGITAL PERIOD	Lights during time interval between dialing digits only when unit is dial pulsing.
CR39	IDLE	Lights to indicate unit is on-hook when the MODE switch is in the IDLE position.
CR40, 41	ON HOOK	Lights to indicate unit is on-hook when the MODE switch is in the AUTO or SINGLE CALL position.

Table 4—3. (cont'd)

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
CR42	TTY	Not used in basic TTS 41-3A unit. Provided for use in conjunction with a future remote output option.
CR43-48	WAITING FOR START DIAL	When lit indicates: 1. Unit is waiting for a programmed delay to expire before dialing if the DELAY pushbutton is depressed. 2. Unit is waiting for dial tone (or wink-type start dial signal) before dialing if the DIAL TONE pushbutton is depressed. 3. If both DELAY and DIAL TONE are engaged, this message is displayed after initial off-hook to indicate unit is waiting for 2 above before dialing. If WSD command(s) are encountered during the dialing process, this message is displayed again to indicate unit is waiting for 1 above before resuming the dialing.
CR49, 50	DIALING	When lit indicates unit is sending dialing signaling (either Touch-Tone, dial pulse, or multifrequency).
CR51-59, 63, 65	DIALING COMPLETED WAITING FOR TEST RESULTS	Lights when dialing is completed. Remains lit until unit determines results of test program.
CR61-62	TEST OK	Lights to indicate that a test call encountered none of the faults unit is programmed to detect. Remains lit until current test cycle is completed and unit returns to on-hook.
CR75-77	SYSTEM HELD	Lights if, for any reason, unit is not automatically recycling.
U3-13	TEST PROGRESS	Displays digits of the number to be dialed. Digits are displayed at half brightness when entered via the keyset. Each digit is brought up to full brightness when dialed out by the unit.
TEST RESULTS GROUP		
CR78-80	OVER RANGE	Lights when total tests category exceeds a count of 9999. To remove the over range indication, the RESET pushbutton is pressed with MODE switch in IDLE position. This action also resets all test result categories to zero.

Table 4—3. (cont'd)

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
CR81-85	POWER INTERRUPT	Flashes to indicate unit's power has been momentarily removed. The off (down) to ON transition of the POWER switch also causes this indicator to flash. When the power interruption indication occurs, the PROGRAM ERROR indicator lights and the unit is held on-hook. To remove power interrupt indication, depress RESET pushbutton with MODE switch in IDLE position for at least one second. The dialing number must be reprogrammed after a power interrupt occurs.
CR 86, 87, 89, 90	PROGRAM ERROR	Lights to indicate incorrect operation of the unit. A program error occurs when a test program is incorrect, or insufficient, or MODE switch is removed from IDLE position while RESET/→/NORM switch is in the → (load) or RESET positions. (See paragraph 4.56.) A program error indication also occurs when a power interrupt condition exists. Unit remains on-hook until program error is corrected.
CR91	NO DIAL TONE	Lights to indicate dial tone was not returned on the selected line within programmed FAULT AFTER (R2) time period. The DIAL TONE pushbutton must be engaged to detect this condition. On units equipped with multifrequency option, this message can also indicate an expected wink-type start dial signal was not received within the FAULT AFTER period when the DIAL TONE pushbutton is engaged.
CR92	OPEN "C" LEAD	When lit indicates C-lead open circuit or potential more negative than −11 volts occurred during dialing or while test results were being determined. To detect this condition, the OPEN C-LEAD pushbutton must be engaged.
CR93	REV DRNG DIAL	Lights to indicate a tip/ring polarity reversal occurred while dialing. To detect this condition, the REV DRNG DIAL pushbutton must be engaged.
CR94	REORDER	Lights when unit detects reorder tone without false tip/ring polarity reversal (answer) while waiting for dial tone or when test results are being determined.
CR95	REORDER + ANSWER	Lights when unit detects both reorder tone and false tip/ring polarity reversal (answer) while waiting for dial tone or when test results are being determined.
CR96	BUSY + ANSWER	Lights when unit detects both busy tone and false tip/ring polarity reversal (answer) while waiting for dial tone or when test results are being determined.

Table 4—3. (cont'd)

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
CR97	BUSY	Lights when unit detects busy tone without false tip/ring polarity reversal (answer) while waiting for dial tone or when test results are being determined.
CR98	LO LEVEL	Lights when level of a received 1-kHz tone is less than the threshold level set by combination of EML control S14 and LO-LIMIT control S13. To detect this condition the 1KHZ TONE pushbutton must be engaged.
CR99	NO 1KHZ TONE	Lights to indicate that a 1-kHz tone having level above −31 dBm (from either 600 or 900-ohms) was not received during NETWORK DLY (R3) time period following completion of dialing. To detect this condition, the 1KHZ TONE pushbutton must be engaged.
CR100	HI LEVEL	Lights when level of received 1-kHz tone is greater than the threshold level set by combination of EML control S14 and HI-LIMIT control S15. To detect this condition, the 1KHZ TONE pushbutton must be engaged.
CR101	NO ANSWER	Lights when unit does not receive a tip/ring polarity reversal (answer) within NETWORK DLY (R3) time period following completion of dialing. To detect this condition the ANS SUP pushbutton must be engaged.
CR102	INC CKT FAULT	Lights when unit does not receive a test call placed to its internal test line during NETWORK DLY (R3) time period following completion of dialing. To detect this condition, the INC CKT pushbutton must be engaged.
S24	RESET	When pressed, resets counts in all test result categories to zero, also removes any power interrupt and over range indications. Reset can occur only when the MODE switch is in the IDLE position. NOTE To remove the POWER INTERRUPT indication, the RESET pushbutton should be pressed for at least one second.
S25	OK	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all tests which resulted in a test OK.
S26	A	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all tests attempted on channel A.
S27	B	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all tests attempted on channel B.

Table 4—3. (cont'd)

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
S28	NO DIAL TONE	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all no dial tone (or no wink) faults detected.
S29	OPEN "C" LEAD	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all open C-lead faults detected.
S30	REV DRNG DIAL	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all tip/ring polarity reversal during dial faults detected.
S31	REORDER	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all reorder tone detections without false tip/ring polarity reversal (answer).
S32	REORDER + ANSWER	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all reorder tone detections which were accompanied by false tip/ring polarity reversal (answer) detections.
S33	BUSY + ANSWER	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all busy tone detections which were accompanied by false tip/ring polarity reversal (answer) detections.
S34	BUSY	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all busy tone detections without false tip/ring polarity reversal (answer).
S35	LO LEVEL	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all low level faults detected.
S36	NO 1KHZ TONE	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all no 1-kHz tone faults detected.
S37	HI LEVEL	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all high level faults detected.
S38	NO ANSWER	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all no answer faults detected.
S39	INC CKT FAULT	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all incoming circuit faults detected.
U14-U17	TEST RESULTS	Normally displays total count of all tests attempted on both channel A and channel B. The count accumulated in any other test result category is displayed when the appropriate test result pushbutton is pressed.

Table 4—3. (cont'd)

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
REAR PANEL GROUP		
F1/F2	fuses	Protect analyzer against excessive input current. Use 2-ampere slow-blow fuses for 115 Vac operation. Use 1-ampere slow-blow fuses for 230 Vac operation.
J18-25	CHANNEL A 0-7	Up to eight telephone lines (T/R or T/R/S) may be connected to this jack field for test call origination via unit's channel A. Unit scans and selects lines under program control. Connections are made via 310 type jacks. Any empty jacks appear busy to the unit and are skipped by the line scanning/selection circuits.
J26-33	CHANNEL B 0-7	Up to eight telephone lines (T/R or T/R/S) may be connected to this jack field for test call origination via the unit's channel B. Unit scans and selects lines under program control. Connections are made via 310 type jacks. Any empty jacks appear busy to the unit and are skipped by the line scanning/selection circuits.
J34	POWER	Unit's input power cord connects to this jack.
S48	SELECT VOLTAGE	Configures the unit for either 115 or 230 Vac operation. The proper fuses must be used for each power source as noted on the rear panel.
TB1	INCOMING CIRCUIT	The T, R, S terminals provide tip/ring/sleeve connections to the unit's internal test line. The XA and XB terminals are not used.

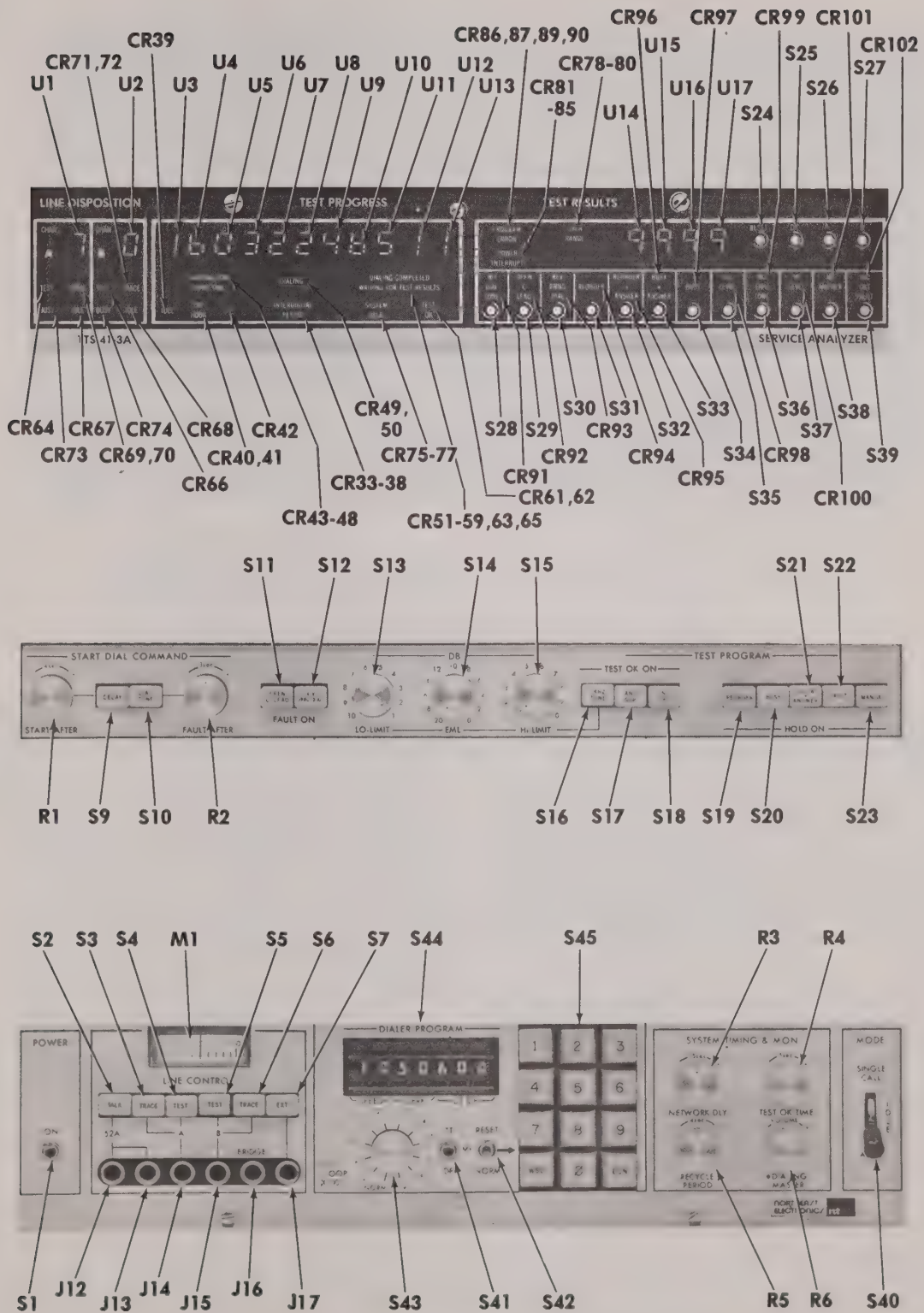


Figure 4—13. Model TTS 41-3A Front Panel Controls And Indicators

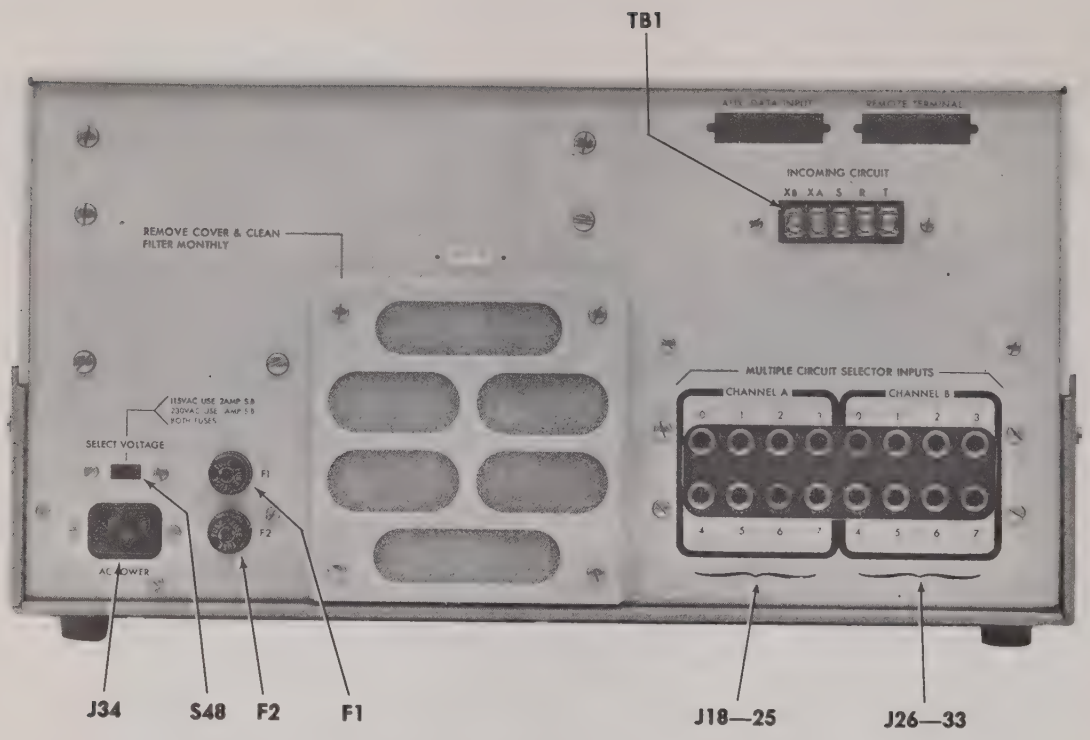


Figure 4—14. Model TTS 41-3A Rear Panel Connectors

4.112 TESTING WITH EXTERNAL EQUIPMENT ON A LINE HELD BY THE ANALYZER

4.113 The analyzer automatically applies a 735-ohm termination to the selected call origination line when off-hook. This 735-ohm termination can affect testing (such as transmission level measurements) performed by external equipment. By using the following procedure, the 735-ohm termination can be isolated from the line under test while tests are being made with external equipment.

4.114 To make transmission level measurements (or similar tests) with external equipment on a line held by the analyzer, perform the following steps.

1. Using a patch cord with a type 310 plug, connect the external test equipment to the analyzer's EXT jack.

2. Select the required termination/impedance and dc holding with the external test equipment.

3. Engage the TRACE pushbutton for the channel associated with the line under test. (This action applies a holding circuit to the line under test while the line is being switched to external equipment).

4. Engage the analyzer's EXT pushbutton.

5. Release the TRACE pushbutton engaged previously.

6. The external equipment should now be providing dc holding for the line under test. The analyzer's 735-ohm termination is isolated from the line. Tests can be performed with the external equipment at this time.

ORDER FORM FOR 41-3A SERIES MANUALS

Other manuals can be purchased for the TTS 41-3A Service Analyzer. They are:

- Service manual (A0041-13-603) that includes theory of operation, schematic diagrams, calibration information, parts lists, etc.;
- MF Option manual (A0041-13-601) for field installation and operation of the 41-3A MF Option;
- Teleprinter Option manual (A0041-13-602) for field installation and operation of the 41-3A Teleprinter Option.

To order any of the above manuals, call Northern Telecom, Inc., Northeast Electronics Division, Spare Parts Department at **(603) 224-6511.** Or complete the order form below and mail to:

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